ARMY ORDNANCE

VOL. XV, No. 85 JULY-AUGUST, 1934

Peace, Real and Unreal
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Shells, Shrapnel and Statecraft
Colonel G. F. B. Turner

The Fighting Man
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"Facts" About Munitions Makers, II
An Editorial

A BIMONTHLY REVIEW OF AMERICAN MUNITIONS
PUBLISHED BY THE ARMY ORDNANCE ASSOCIATION, WASHINGTON, D. C.

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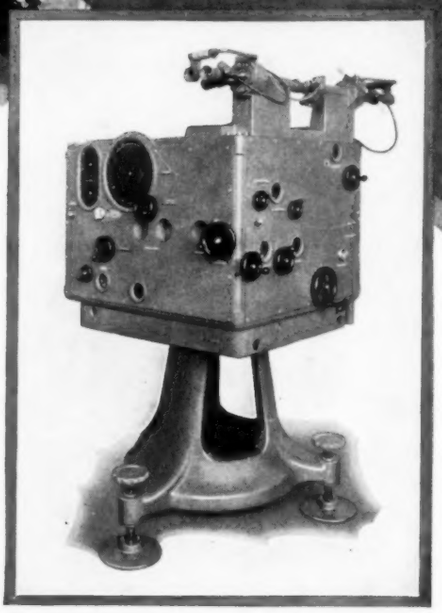

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Now in its Fifteenth Year of Publication

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"Economy in all branches of the public service is due from all the public agents to the people, but parsimony alone would suggest the withholding of the necessary means for the protection of our domestic firesides from invasion and our national honor from disgrace."—*President John Tyler, First Annual Message, December 7, 1841.*

The Army Ordnance Association

THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guarantee of peace.

The Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

THE Army Ordnance Association believes that the solution of this problem, based on experience, lies in an active organization at all times coöperating with the Government. The principal objective of the Association is an active membership of American citizens, on whom the duty of design and production of munitions will fall in war, who will have an accurate and authentic knowledge of the complex requirements of ordnance. "Peace insurance" in this form is the foremost aim of the Army Ordnance Association.

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ARMY ORDNANCE, the journal of the Association, is published solely for the purpose of disseminating information on the progress of our munitions developments so that American industry may at all times know its responsibilities to the common defense.

The objectives of the Association as set forth in its Constitution are:

To assist in effecting industrial preparedness for war as being one of the nation's strongest guarantees of peace;

To keep available the highly specialized knowledge necessary for arming the manhood of the nation by stimulating interest in the design and production of ordnance material;

To promote mutual understanding and to effect cooperation with American scientists, inventors, engineers and manufacturers in civil life and the regular and reserve officers of the Ordnance Department;

To provide, when required, the services of competent committees to investigate and report upon special ordnance subjects;

To assist in developing and maintaining an efficient personnel, both commissioned and enlisted, for the units required for Ordnance Field Service in the event of an emergency;

To commemorate the services rendered by the industry of the nation and by the officers and civilian employees of the Ordnance Department in the wars in which the United States has been engaged.

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Brigadier General Herman W. Schull
Assistant to the Chief of Ordnance of the Army

ARMY ORDNANCE

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Peace, Real and Unreal

"Disarmament" Proposals and "The Next War"

By John Bassett Moore*

ARTICLE 8 of the Covenant of the League of Nations opens with this paragraph: "The Members of the League recognize that the maintenance of peace requires the reduction of national armaments to the lowest point consistent with national safety and the enforcement by common action of international obligations." There then tripple along, in the same article, five more neatly turned paragraphs, and, taking all six together, they stand before the world today, fourteen years after their adoption, as another illustration of the propensity of the human mind to seek in glib phrases a refuge from its disinclination and failure to grapple with stern realities. Nor is this all.

Article 8 of the Covenant carries at least two false implications. The first is that national armaments have been a prime, if not the chief, cause of wars; the second, that nations can, as regards the "lowest point" in armaments "consistent with national safety," be brought to accept, without mental reservation, the judgment of others. What is meant by "national safety?" Evidently, nothing but the ability to whip an adversary, without regard to size or numbers. It is only where nations find it possible to take a broader view, as was done in the abolition of naval armaments on the Great Lakes, that they can effectively deal with "disarmament." If Article 8 of the Covenant has failed, this is mainly because, like so many other provisions of the same instrument, it was based on superficial assumptions, which furnished no solution of fundamental difficulties.

I am not here expressing thoughts first suggested by recent events. In a volume published more than twenty years ago, I ventured to affirm that the connection between armaments and military conflicts had been misconceived and greatly exaggerated, and that questions of war and of peace depended and would continue to depend "not so much upon the size of military establishments as upon the cultivation of the spirit and habit of justice, of self-control, of reciprocal recognition of rights and of forbearance;" and that, if these things were not practiced, all plans for the preservation of peace would "prove to be as so much waste paper." The truth of these statements is demonstrated by the history of civil wars as well as by that of international wars. No one could attribute either our own civil war or our participation in various foreign wars, including the last one, to our excessive armaments. Neither the possession of great armaments by others nor the lack of them by ourselves sufficed to deter us from going in. Where participants in a war have large armaments, the number of soldiers immediately engaged will naturally be greater, but this does not mean that the war will thereby be prolonged or that the eventual aggregate of losses will be greater. The truly world wars growing out of the French Revolution continued, with a brief intermission, more than twenty-two years.

While it is a fact that during the past twelve years certain agreements have been signed for the limitation of naval armaments, no one can truly say that they embody the heartfelt assent of the signatories to the limitations imposed upon them. It is for this reason that they have contributed so much to the growth of international ill feeling, and particularly to the estrangement between the United States and Great Britain, in which the question of international debts has, in my opinion, played a very minor part.

THERE is yet another fallacy that widely prevails in regard to the question of disarmament. I refer to the distinction commonly made between "offensive" and "defensive" armaments. We are told that, if "offensive" armaments are abolished, then all other armaments become "defensive." Some have been so irreverent as to call this claptrap. It might more politely be called a truism, but even as a truism it lacks a basis in reality. Military men, who may properly be regarded as experts in this matter, are utterly unable to agree as to what armaments are offensive and what are defensive. It has been proposed at Geneva that all "offensive" armaments shall be turned over to the League of Nations to be used for the common good. Probably it was thought the tension might be relieved by a flash of humor. How long a government could survive that turned over all its offensive armaments to the League of Nations it is unnecessary to conjecture, so quick would be its repudiation by its own people. Fundamentally, armaments are offensive or defensive according to the intention with which they are used. Probably no one would have thought of classing the *machete* as a military weapon, either offensive or defensive. For the benefit of those who may not know what a *machete* is, I may explain that it is an implement for cutting sugar-cane; but it may be equally effective for cleaving human skulls, and so it proved to be. The battle-cry of the insurgents in Cuba in 1895 was *"á el machete,"* and the Spanish regulars prudently took to their barracks. There is yet another phase to be considered. As shown by the recent great conflict, wars give rise to the invention and use of new devices, offensive as well as defensive. For instance, tanks, which are preëminently useful for offensive purposes, came into use during the recent war, and a previous specification of offensive weapons would not have inhibited them. Indeed, if war breaks out, all weapons become defensive as well as offensive.

There is no writer in the United States who has dealt with

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these questions more candidly and more sanely than Mr. Frank H. Simonds, who has lately remarked that there exists in the United States a "vast confusion" on this subject; that no agreement for the limitation of armaments can be regarded as furnishing an assurance of peace that is not based upon the mutual recognition of rights and the satisfaction of what each nation conceives to be its essential needs, and that, before a real "disarmament" can be reached, the majorities in the various nations must be brought to recognize the basic truth that the "price of peace is the surrender of national rights and the sacrifice of national interests." By this I take him to mean the abatement by each nation, in some substantial measure, of its claims of national right and national interest, in the interest of all concerned. Taking the long view, such abatement and such sacrifice might turn out to be in the interest of each as well as of all.

UNHAPPILY, no such disposition as this has been shown in the disarmament conference that has so long been hanging over us at Geneva. On the contrary, there has been an obvious purpose to secure and maintain a preponderance of power on the part of certain nations, and, as a further assurance, to induce the United States to pledge its great resources in men and in money to another "peace through victory." This proposal has assumed various elusive forms; and, as an inducement to its acceptance, we were at first told that the law of neutrality had become obsolete and was a thing of the past. But, when it was demonstrated that this assertion was flagrantly at variance with what the governments and courts of the world were daily saying, another tack was taken. We were asked to enter into a "consultative pact" for the suppression of "aggressors," but this too failed to stand the test of examination. Finally, after these reverses, it is now intimated that it will suffice if, abandoning the "old-fashioned neutrality," we shall agree to coöperate in an "economic boycott" of any "violator" of the proposed "arms pact." The phrase "old-fashioned neutrality" is not fortunate. It would be as sensible to speak of old-fashioned honesty, of old-fashioned truthfulness, or of old-fashioned law observance. A nation is either neutral or it is unneutral, and, if unneutral, it will be dealt with by other nations according to its character and its conduct. The latest proposal also involves the fallacy that warlike measures may be disguised by supposedly peaceful titles. Economic boycotts and economic sanctions are not peaceful measures. They are essentially warlike, and involve modes of action which naturally lead to open war.

In this connection an effort is made to console us with the thought that it would be left to us to decide regarding the "aggressor" or the "violator." We should be on our guard against such deferential suggestions. No doubt it was in one sense left to us to decide whether we should enter the "world war;" but in an article on "Anglo-American Friendship," published by Mr. Herbert Agar in the *Nineteenth Century* (London), as late as January, 1933, we find this sentence: "During the war the astonishingly efficient British propaganda service convinced the Americans of some of the most bizarre fairy tales that have ever been devised. To this day most of the population has not recovered from the alleged information which it then swallowed whole." Mr. Agar may be accepted as a highly informed and expert witness, and the very terms in which his avowal is made indicate his belief that our gulping capacity remains unimpaired. Nor should we forget the fact that, by reason of our participation in the World War and in the making of the so-called peace, we took part in the creation of the political volcano commonly called the Versailles Treaty. Do we long to furnish further proofs of our wisdom and benevolence as a "world power?"

Fully appreciating, as I do, the dangers in a "race for armaments," I am not disposed to deprecate the friendly discussion by governments of the limitation of armaments, or friendly agreements on that subject. But, in undertaking to apply "sanctions" to the "violator" of the pact now proposed, we should obviously be looking to participation in the "next war," and might, if we are a rational people, be assumed to contemplate, as the "violator" of the pact, the nation that is least armed rather than the one that is best armed.

THE PENNSYLVANIA LEADING THE U. S. BATTLE FLEET IN REVIEW.

Shells, Shrapnel and Statecraft

Great Britain's Ammunition Supply in the World War

By Colonel G. F. B. Turner, D. S. O.*

IN the conduct of war, the struggles for supremacy between methods of attack and systems of defense goes on unceasingly, vantage inclining first in one direction then in the other, as new tactics are evolved or new material discovered. The invention of gunpowder, making castles obsolete and greatly reducing the military value of walled cities, demanded a new system of defense, a demand met in due course by the emplacing of ordnance behind upstanding earthen ramparts with or without masonry facing. As artillery increased in power, range and accuracy, and acquired through aircraft the indispensable eye, the scales turned once more in favor of the attack. The value of fortresses diminished and at an early stage of the World War, the speedy reduction of Liége and Namur led to the recognition of labyrinthine field works, camouflage and movable armament as essential features of a defensive zone.

After the German onfall had been checked at the Marne, the problem before the Allies was that of breaking through a continuous and complex network of trenches, protected by jungles of barbed wire, from behind which the machine gun and rifle fire of an invisible foe supported by a numerous and skillfully concealed artillery, was certain to take heavy toll of an attempted advance.

There were various views as to how the unavoidable frontal attack could be carried out with a reasonable chance of success, and it was here that the idea of a mechanically driven, bullet-proof machine gun destroyer, capable of forcing its way through wire and over trenches and so opening up a path for the infantry, took shape in the fertile brain of Colonel Swinton. But the day of the tanks was not yet. The method favored by the Commander of the British Expeditionary Force, with the means at his disposal was: a preliminary cutting of the wire by prolonged shrapnel fire from the field batteries; then at zero hour a heavy and concentrated bombardment followed by the infantry advance. This conception had a limited success at Neuve Chapelle in March 1915, but its defects were not grasped by Sir John French and the failure of later attacks, similarly staged, in May, were wrongly attributed to a deficiency of high explosive shell for the Field Artillery.

The Commander-in-Chief was completely ignorant of manufacturing processes, and of the time required to produce ammunition on the enormous scale his new tactics demanded, nor had he any technical officers on his staff to enlighten him. Worse still he nursed a feeling of resentment against the Secretary of State for War—Lord Kitchener—for what he considered to be an unwarrantable interference with field operations at the time of the retreat from Mons and he lent himself only too readily to intrigues which had for their object the discrediting of his superior.

Hence arose the so-called "Shell Scandal": the charge that Lord Kitchener, as head of the War Office, had failed to foresee and provide for the nature and quantities of gun ammunition necessitated by positional warfare on the grand scale, and more particularly that he had supplied the field guns with shrapnel instead of high explosive shell. Inaugurated by Colonel Repington and Mr. Lloyd George, and fomented by the Northcliffe press, the agitation was the principal factor in bringing about the downfall of the Liberal Government, and the creation under a Coalition Government of the Ministry of Munitions with Mr. Lloyd George at its head.

The echoes of the controversy have not yet died away. Successive authors—Lord Esher, Lord French, Colonel Repington and the first Minister of Munitions—have repeated and enlarged on the misstatements of *The Times* and *Daily Mail*. Only one dissentient voice—that of Sir George Arthur, Lord Kitchener's biographer—had been raised, until, in December last year, the present writer in the columns of *The English Review* categorically refuted the main charges against the War Office. Still more recently, two of Mr. Lloyd George's successors in the Ministry—Dr. Addison and Mr. Winston Churchill have in their published work endorsed the original charges. Through the courtesy of ARMY ORDNANCE an opportunity has been given of putting before an American public, a public which numbers in its ranks countless admirers of Lord Kitchener, a resumé of that part of the *English Review* article which concerns ammunition supply.

MR. LLOYD GEORGE in his Memoirs claims that his letter to Mr. Asquith, dated May 19th 1915, played an important part in bringing about the formation of the Coalition Government. In this letter, repeating the opinions expressed in a Secret Memorandum from Sir John French, he states:

1. That shrapnel is useless and H. E. shells indispensable for the attack of highly developed trenches protected by barbed-wire entanglements. 2. That the Commander-in-Chief in France had impressed this on the War Office for months and asked for 50 per cent of H. E. shells. 3. That notwithstanding these urgent representations the percentage of H. E. shell for 18-pdrs. has never exceeded 8 per cent. 4. That the horrible loss of lives on May 9th at Festubert was due to the lack of H. E. shells. 5. That private firms cannot turn out shrapnel because of the complicated nature of the shell, but that any engineering firm could produce the simple H. E. shell.

He also states in the Memoirs that high explosive ammunition had not been seriously and systematically investigated by the War Office before the War, and that the War Office had failed to take the steps necessary to provide a sufficiency of ammunition of all kinds.

It is proposed, within the limits of the space available to examine these criticisms in detail.

STUDY of High Explosives before the War. In the British Service, all investigations dealing with guns and ammunition were and are carried out under the ægis of the Ordnance Board (or Committee), a body of senior officers of the Army

*Formerly Assistant Superintendent, Royal Laboratory (Now Royal Ammunition Factories), 1914-1916; Superintendent of Trench Warfare Design, Ministry of Munitions and later commanded an artillery brigade in France. When he retired from active service in the British Army Colonel Turner was superintendent of Design at the Woolwich Arsenal, London, England.

and Navy, specially selected for their wide technical knowledge and acquaintance with service conditions. Information obtained in the course of experimental work for the Navy is naturally available for the Army, and vice versa. A vast amount of research had been done on high explosives before the war but the results were of course regarded as extremely confidential. It is, however, now an open secret, that detonation, which roughly speaking is a wave action involving the instantaneous resolution of the explosive into its constituent elements, is more difficult to achieve in a small shell than in a large one, and that whilst shells of 5-inch caliber and upwards can be detonated by a fuze filled with gunpowder, smaller shells must be actuated by a fuze which itself detonates. A further point is that premature action in the gun of a shell filled with high explosive is liable to blow the gun to pieces, with disastrous results to the detachment.

Shell filled with high explosive (lyddite) were first used by the British Army in 1898 at the Battle of Omdurman, and were employed on a larger scale in the South African War. They were not an unqualified success, on account of incomplete detonation and casualties caused by prematures, but their potential value was clear, and from 1902 onwards unremitting attempts were made to obtain a safe fuze that would effectively fragment the shell. By August, 1914, much progress had been made and a safe and tolerably efficient system of detonating the shell when it struck directly on its *nose* had been devised for the Navy (Fuzes No. 44 and 45); the more difficult problem of satisfying land service conditions, where the fuze is required to act when the shell merely grazes and ricochets from the ground, was not quite solved.

Fig. 1. Fuze Designed December, 1914

It is known as No. 101. 113,000,000 were made and it is believed there was not a single failure of the safety device. In 1918 prematures averaged 1 in 200,000. Such prematures were not necessarily due to fuze failure. The shell was filled with lyddite, the booster charge was trotyl.

High explosive ammunition was not available for British field guns in August, 1914, because when the new 13-pr. and 18-pr. long-recoil equipments were introduced (1903), it was decided after extensive trials that H. E. shell were not required. The General Staff concurred in this and in 1907 put on record that in adhering to shrapnel alone for field guns they were taking a perfectly sound course. High explosive effect, which it was agreed had its value, was provided for by adding a proportion of 4.5-inch field howitzers (firing a 35-lb. shell) to each division.

In 1911 and 1912, reports on H. E. shell used by the French field artillery were received at the War Office, but no change of policy ensued. Sir John French, then Chief of the General Staff, discussed the matter with the Master General of Ordnance (Sir Stanley von Donop) and expressed himself as satisfied with what was being done.

In 1911, the War Office initiated trials with an 18-pr. combined shrapnel and H. E. shell similar to the continental type. A satisfactory solution of a difficult problem had almost been reached by August, 1914, but no further action was taken, as war-time supply in quantity would have been out of the question. The Germans had this ammunition and after two years' war experience abandoned it. In all the systems, British and Continental, the use of light gun H. E. shell was for the attack of *shielded guns,* not entrenchments, for which latter purpose the shell is too small.

War Office action with regard to introduction of H. E. for field guns. It would be more correct to say that the War Office *forced* 18-pr. H. E. upon the British Army in France than to accuse it of failure in the face of continual requests to supply. Sir John French's memory must have played him a sorry trick when the Memorandum was composed, for in June, 1915, he admitted in writing that the War Office had taken the initiative in this matter.

Before the end of August, 1914, the Master General of Ordnance had gathered through private reports from the front that the H. E. shell with a time fuze used by the Germans was causing severe damage to our troops; on 31st August he asked the General Officer Commanding Royal Artillery at General Headquarters to ascertain if H. E. shell was wanted for 13- and 18-prs. The attitude of G. H. Q. was lukewarm and it was only after repeated enquiry that on 15th September an affirmative reply was received.

Whilst this correspondence was proceeding, independent action had been taken by the Government ordnance factories to such purpose that when the Commander-in-Chief's concurrence was obtained a satisfactory design had been improvised and considerable progress made with manufacture.

Fig. 2. Improvised H. E. Ammunition

This was the H. E. ammunition improvised in September, 1914, for use in 18 Pdrs. The shell filler was lyddite; the cartridge charge was cordite. The only new part was the adapter—shown supporting a No. 44 fuze (below) under No. 80 fuze (above).

The design, suggested by Colonel Sir Hilaro Barlow, the head of the Ammunition Factories, comprised a shell bored straight from steel bar, fitted with two fuzes of approved pattern, a No. 80 time fuze being used to blow in the pressure plate of a No. 44 detonating fuze placed below it. These fuzes being under manufacture in the Arsenal were immediately available. It may be remarked *en passant,* that large numbers of both natures were manufactured in America during the war, and it is believed that the safety shutter device of No. 44 is a feature of American bore-safe fuzes of current design.

This anticipation of Sir John French's decision made it possible to send a consignment of 1,000 rounds overseas at an early date (19th October) for trial and report. G. H. Q.'s verdict, dated 6th November, was favorable, and it was *then*

FIG. 3. 3-INCH H. E. SHELL

The shell was filled with amatol; the cartridge charge was cordite. The arrangement is the same as for 18-Pdrs. When the improvised time H. E. was superseded by the more simple percussion H. E. (Fig. 1), the time H. E. fuze was retained for antiaircraft guns.

that the C.-in-C. asked for 50 per cent of his future supplies of 18-pr. ammunition to be H. E. In other words, Sir John French's request was not a criticism of the War Office, but *a report on action initiated by the War Office.*

War Office procedure on receipt of Sir John French's demand for 18-pr. H. E. Prompt and appropriate action was taken, but it was clear to the Master General of Ordnance's department from the outset that full requirements could not be met for many months, and had Sir John possessed the most elementary knowledge of the processes involved in the production of complicated stores like fuzes by the million, he also would have realized the sheer impossibility of early satisfaction of his demands.

The 80/44 fuze combination was only intended to be an emergency measure. The time required for the manufacture of *two* fuzes was a very serious objection, and when the new ammunition was demanded in large quantities, the War Office at once set itself to obtain a more simple pattern.

So far from ordering shrapnel instead of H. E., Lord Kitchener was one of the earliest to take action to obtain adequate supplies of H. E. for the British field guns. In view of the urgent need, he insisted on a thorough trial of a new pattern of 75-mm. H. E. shell and fuze recommended by the French authorities, but regarded as unsafe by the Master General of Ordnance, and in accordance with his arrangements, 1,000 rounds of French ammunition were received and expended in firing and other tests under the supervision of the Ordnance Board.

The Board's verdict was that the ammunition contained dangerous features which rendered it unsuitable for the British service. The decision not to adopt it was sound. In a few months the French had lost 800 guns through premature explosions and Joffre's contemplated offensive had to be postponed.

The 75-mm. ammunition having been found unacceptable, the Secretary of State gave orders for the M. G. O.'s Designs Branch to submit proposals for 18-pr. H. E. to give the same performance as the French pattern, but with greater safety.

The Designs Branch had been working assiduously during the trials, and by a happy inspiration the problem that had baffled all attempts for twelve years was solved in as many days. A small scale firing trial was carried out on December 16th with complete success, the War Office at once approved, and within a fortnight contracts for millions of the new fuze had been placed in England and America. The English firms hampered by trade union restrictions, made slow progress, and the first supplies of empty fuzes were received in June, 1915, from the Yale and Towne Co., U. S. A. These fuzes had to be inspected, proved and filled, before assembly in the shell. The first completed rounds with the new fuze went overseas in July, 1915, and this in the writer's opinion, and speaking with a full knowledge of the subject, was the *very earliest date at which Sir John French's demand for large-scale supplies of 18-pr. H. E. shell could be met.*

When it is realized that it was not until the end of October, 1914, that G. H. Q. France could say whether the troops who had to use it wanted 18-pr. H. E. or not, that some five weeks or so were taken up in investigating the possibilities of the French pattern, and that after the French pattern was found unsuitable, it was necessary to design and test a new fuze-shell combination, it is amazing that the Secretary of State should be blamed for delay; the wonder is that the M. G. O.'s departments should so promptly have met requirements where every day occupied by the investigation meant delay in placing contracts.

The statement in the last paragraph of Mr. Lloyd George's letter showed that the writer had not at the time grasped the difference between a shell and a complete round of ammunition, and that like Sir John French he had no knowledge of manufacturing processes. The empty shell is the easiest part of production, but is of no use without the other components—propellant, cartridge case, explosive, primer and fuze. Particularly the fuze. And there we come to the heart of the munitions problem and the key to the situation in May, 1915. The real shortage was not a *shell* shortage, but a *fuze* shortage. And it was one which under the circumstances could not have been overcome by May, 1915, even if the Ministry of Munitions as organized in 1918 had been in existence on 1st January, 1915. For the production of fuzes in quantity is *not* a simple matter.

Mr. Lloyd George in his Memoirs makes great play about lack of imagination at Woolwich Arsenal with regard to production of fuzes, and speaks of the empty shell without fuzes as being a "collection of harmless steel mugs." The "mugs" were not confined to the manufacturer's shops, and it was many months before certain officials of the Ministry of Munitions, including the Minister himself, understood the full meaning of "components" and learned that it was not sufficient to order shell only. The failure of the Ministry to provide a complete round of ammunition until ten months after its formation, is attributable to this ignorance of what to the War Office was a commonplace.

Shrapnel versus H. E. The burden of the Commander-in-Chief's opinion as expressed to and repeated by Mr. Lloyd George was that, 18-pr. shrapnel was useless and 18-pr. H. E. indispensable to the successful attack of trench systems. Later experience, however,

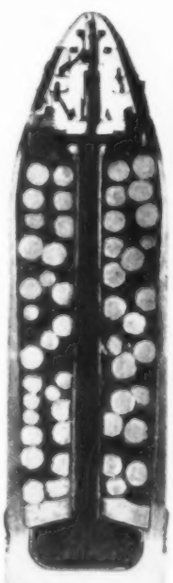


FIG. 4. SHELL SECTION

An 18-Pdr. field gun shell filled with shrapnel. The bullets, set in resin, weigh 41 to the pound. While an H. E. shell bursts into fragments, shrapnel shells are in a sense, small guns in flight blowing out their charge of bullets like hail from a sporting shot gun.

showed that 18-pr. H. E. when supplied in quantity failed to be any improvement on shrapnel for *purposes of attack*. In other words, Sir John French's statements as to what he could do with 18-pr. H. E. were based on a false appreciation of its possibilities, and the war correspondents, press writers, and Mr. Lloyd George and his associates who shared and promulgated Sir John French's views stand condemned with him.

Be it remembered that trials against wire entanglements carried out in January, 1915, proved that rather more effect was obtained with shrapnel than with H. E., and at Neuve Chapelle the good results obtained from shrapnel were fully realized, yet Mr. Lloyd George is explicit that shrapnel is of no use for wire cutting. The Army in France soon learned, what the War Office had known from the beginning, that 18-pr. H. E. was of little value for the destruction of trenches, and in 1917, Sir John French's successor, Sir Douglas Haig, reported that 18-pr. H. E. with non-delay fuze was not a very effective projectile for wire cutting.

The fallacy of the belief that an unlimited supply of H. E. shell would in itself enable the British Army to blast its way through the enemy's defenses, was completely exposed by the poor returns obtained for an enormous expenditure of men and ammunition on the Somme in 1916. Changes in strategy and tactics were necessary before the full value of the enhanced artillery support could be realized, and those changes were worked out long after Sir John French had returned to England.

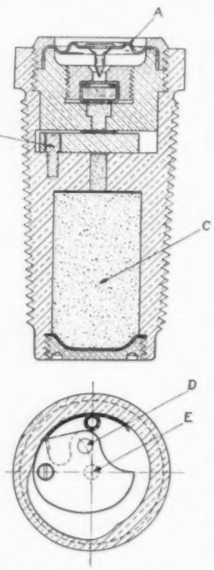


Fig. 5. The No. 44 Fuze

A—Copper pressure plate. B—Axis pin. C—H. E. pellet. Safety shutter swings about axis pin B and shifts explosive channel from D to E.

In those changes, shrapnel maintained its position as an essential for 18-pr. guns both in attack and defense, and a large percentage of shrapnel is still part of the British establishments for all *guns*.

In the closing months of the war, the writer served with a brigade of field artillery on the Western Front in support of three divisions—51st, Canadian, and 39th—which justly ranked very high as storm troops in German estimation. None of them expressed a preference for H. E. instead of shrapnel. For the attack of September 27 on the Canal du Nord, one of the strongest positions in the Hindenburg Line, the Canadian Corps ammunition orders for 18-prs. were "Shrapnel up to the limit of the fuze." The attack, made without tanks, was completely successful. A fortnight later, the 51st Division asked for the 18-prs. to fire shrapnel throughout their attack on a strong machine gun position. This operation was also successful.

Many similar instances could be quoted to show the value attached by British infantry to shrapnel barrage fire in support of an advance.

ALLEGED failure of the War Office to make provision to meet Sir John French's demands for ammunition generally. Mr. Lloyd George's charges on this count are contrary to the facts of the case, and come strangely from the man who in January, 1914, denounced expenditure on armaments: said the outlook had never been more favorable for peace; and later insisted on a cut of half a million in the Army estimates which could only be achieved by omitting therefrom the provision for machine guns and artillery reserve ammunition.

The British Government entered the war on August 4, 1914, committed to supply 6 infantry divisions and a cavalry division for service overseas, and with the general feeling that the war would be over before Christmas. Lord Kitchener alone foresaw a long drawn out campaign for which the country would have to train and *equip* all its available manhood, and on taking over the War Office on August 6th he gave immediate effect to his belief; increasing the contribution to 70 divisions, and issuing instructions to provide complete equipment for *six* armies of the size of the existing one. The placing of contracts for the munitionment of the new armies overwhelmed the already stressed capacity of the recognized sources of supply, and as the campaign proceeded and it was seen that ammunition expenditure was on a scale hitherto undreamed of, the War Office realized that exceptional measures were necessary and *took them*.

Before the end of August, Canada and the U. S. A. had been called on for assistance. An option on a million rounds of gun ammunition offered by the Bethlehem Steel Corporation was accepted within four hours, and Lord Kitchener shortly afterwards made an agreement with Mr. Schwab, which secured the immense capacity of the firm for the Allies for the rest of the war.

The War Office, at an early stage, adopted the plan—subsequently copied by the Ministry of Munitions—of organizing around the existing armament firms. It did not however limit itself to such establishments, and orders placed in England involved the employment of 2,500 to 3,000 firms. By April, 1915, contracts had been made for approximately 30,000,000, complete rounds of 18-pr. ammunition and other natures in proportion.

It is not disputed that ammunition supplies to Flanders in May, 1915, fell far below demands, but had performance come up to promise, there would have been a *surplus*. The verdict as to responsibility hinges, therefore, on the answer to the question, "Why were the promises not kept?" Many cogent reasons were put forward—shortage of labor, trade union restrictions, bad time-keeping, drink, etc., etc., and the War Office, fully alive to the situation, made strong representations to the Government without obtaining much support. No doubt each of the factors mentioned proved a hindrance, but though all were unfortunate and some were reprehensible, discussion of their relative importance would be unprofitable. For they were dwarfed by the root cause, *i.e.*, the shortage of fuzes, and particularly the shortage of fuzes suitable for H. E. shell.

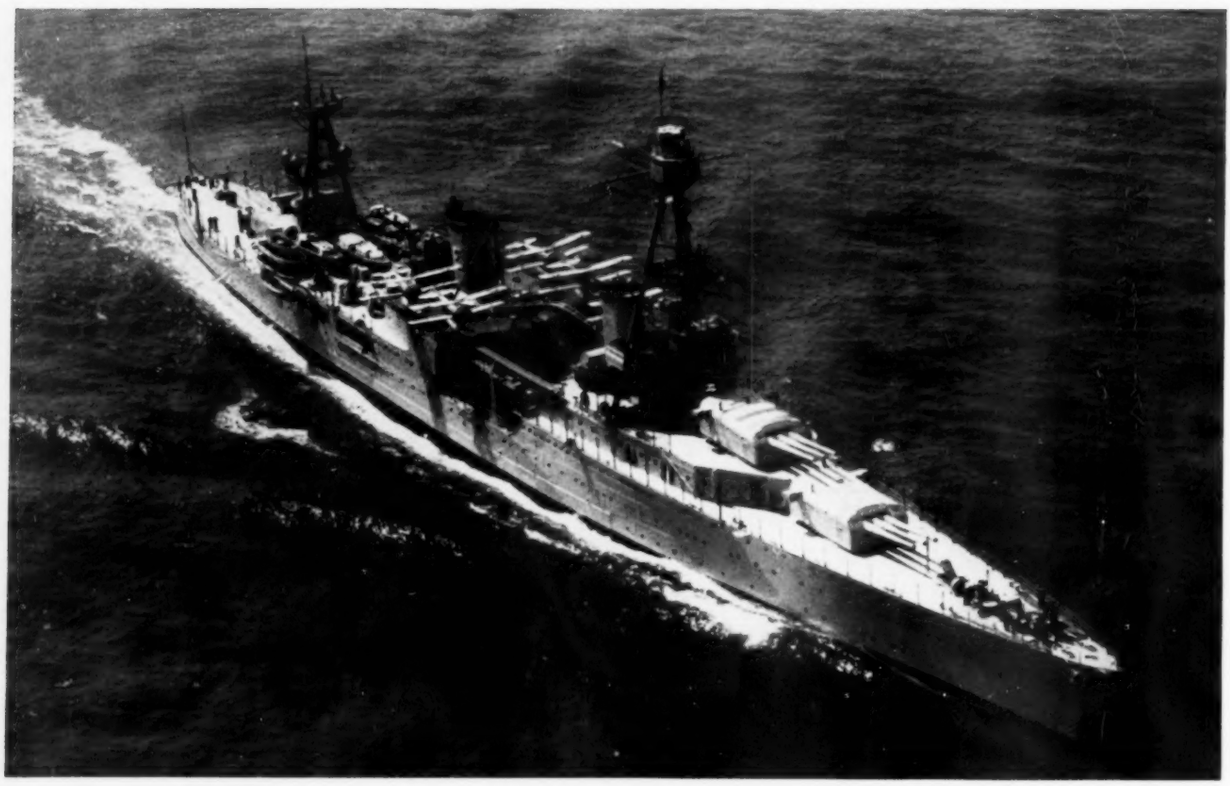
The new fuze, the development of which has been described, was so designed as to be suitable for all guns and howitzers, and was approved and ordered as such. When fuzes became available, output of complete ammunition rose enormously, and Sir John French's estimated requirements (921,000 rounds per month from August 1, 1915), as given in his memorandum to Mr. Lloyd George, were exceeded in October, during which month the number sent to France totalled 1,200,000, not a single round of which had been produced under orders from the Ministry of Munitions. It is thus clear that Mr. Lloyd George's charges in his much heralded memoirs were based—to put it mildly—on ignorance.

The Navy—Our First Line of Defense

THE U. S. S. PORTLAND AT THE FLEET REVIEW, NEW YORK, N. Y., MAY 31, 1934.

Scenes at the Presidential Review

The Flagship of the Fleet Heading the Column.



The U. S. S. Chicago.

As the U. S. Fleet Entered New York Harbor

DESTROYERS AND BATTLESHIPS IN REVIEW FORMATION.

THE U. S. S. NEW YORK.

A Component of National Security

Destroyers Passing in Review.

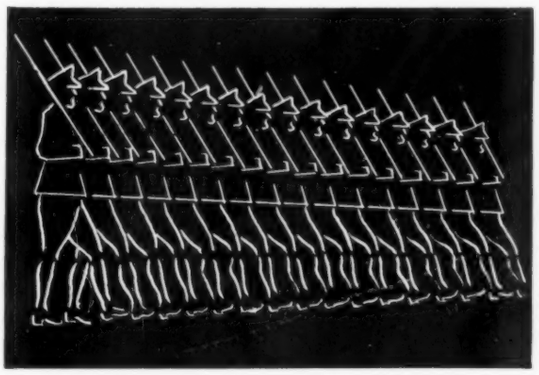
The U. S. S. Pennsylvania Viewed from the Air.

The Fighting Man

His Attributes are Courage, Honor and Prudence

By Hoffman Nickerson*

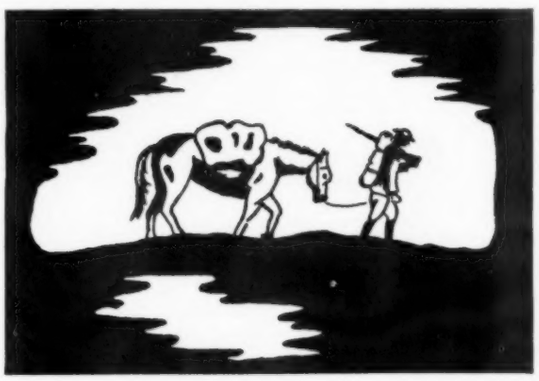
THE primary instrument of war is the fighting man. All weapons, organization and training are intended to help him conquer his enemy. As a citizen he is concerned with the policy of his country or other group, since his coöperation is necessary to those who govern and his advice may be asked by them. Indeed a close connection between arms and policy is necessary to the success of both. But as a fighting man he is concerned only with victory.



THE fighting man must face hardship and death; therefore without courage he can do nothing. Although a competent commander will spare his men whenever he can, nevertheless the military necessity for victory requires the greatest efforts and sacrifices. Whether or not the political object of the war be a limited one, the fighting men must strain every nerve to win; the one restriction upon them is that they must be careful not to violate the established laws of war—except insofar as they must do so in order to cope with an enemy who has set the example in so doing, and even then every violation shocks the conscience of mankind and may bring in neutrals against the violator. In practice, fresh and well fed men have often found it easier to risk wounds and death than to face the acute discomforts so often encountered in active service. When Shakespeare's Octavius wishes to praise Antony's soldiership he speaks not of his battles but of his cheerful endurance of hardship:

" . . . . at thy heel
Did famine follow; whom thou fought'st against
Though daintily brought up, with patience more
Than savages could suffer. . . . .

On the Alps
It is reported thou did'st eat strange flesh
Which some did die to look on; and all this . . . .
Was borne so like a soldier that thy cheek
So much as lank'd not. . . . ."



One of Washington's papers expresses the same thought: that hardship rather than danger is the chief test of fortitude; Napoleon said that privations were the school of good soldiers. Accordingly care is taken of the physical fitness of soldiers because physical courage is usually greater among strong and healthy men. On the other hand, death is perhaps the most absolute thing known to man; to face it requires the greatest courage of which he is capable. All men have a larger or smaller measure of natural, animal courage, and when filled with fanaticism or fury they will sometimes throw their lives away recklessly, but a more constant and reliable courage is that due to training and most of all to military honor. All military training seeks to increase natural courage; through habit it increases the fighting man's confidence in himself, his weapons, and his comrades. Through constant repetition he gains the habit of obedience and a certain familiarity with what will happen in combat; accordingly his mind is somewhat fortified against the shock of unexpected sights and sounds. The chief mark and most necessary virtue of the true fighting man is military honor; he must rigidly school himself to prefer death to the shame of cowardice.

COURAGE, although the chief virtue of the fighting man, is not the only virtue which he must possess; he must also know how to fight intelligently. The bull is full of courage but is almost invariably killed by the matador. A Prussian officer, playing on the distinction between what is morally and what is intellectually easy, is reported to have said: "To die is easy. But what is wanted is to make the enemy die which is much more difficult." Without pausing over the typically Prussian confusion of thought which makes death and destruction ends in themselves instead of mere means toward victory, let us remember that intelligent sacrifice always has value toward achieving success, or toward future success by setting an inspiring example; the memories of past valor are among the most precious possessions of a fighting group. Wise military conduct is that which puts the chances of war in one's favor; this is the object of military theory.

In all doubtful cases the balance between courage and prudence should be tilted heavily in favor of courage. Since,

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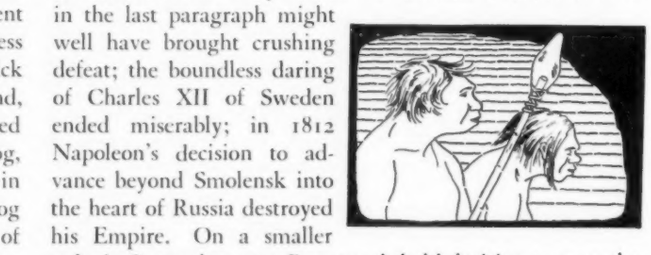
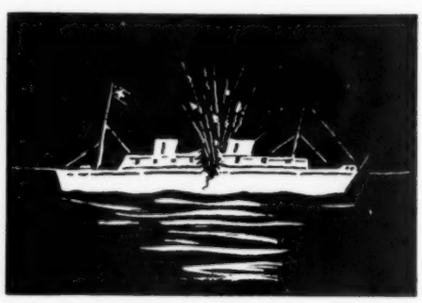
as we have just seen, military theory seeks to put the chances of war in our favor, some conflict between boldness and caution may arise. Accordingly the student should always remember the advantages of boldness, especially unexpected boldness, in surprising or disconcerting an enemy. In the experience of the present writer, a little girl of less than three without a stick or a stone in her hand, seeing her puppy attacked by a large police dog, rushed out of the house in such a fury that the dog ran away. The history of war has many examples of successful audacity: for instance, Marlborough at the Schellendorf in the week before Blenheim, Frederick the Great at Torgau and especially at Leuthen, Napoleon at Arcole, and Lee at Chancellorsville. Clausewitz judged that Frederick decided to attack the greatly superior numbers of the Austrians at Leuthen only because he had filled his mind with the thought of dying with honor and not because he thought it probable that he might defeat them by using the oblique order. The German offensives of 1918 were not far from enterprises based upon despair: given the proved strength of the defensive in trench warfare it must have seemed improbable that they could succeed, moreover the steady arrival of American reenforcements made it still more improbable that they could long be continued. And yet they nearly achieved a success so great that it would have modified the outcome of the war and might even have resulted in German victory. A man so cautious as to be completely without courage could never expect to win, indeed he could hardly fight at all; whereas rash daring has almost always some chance, however slight, in its favor.

Nevertheless prudence has its rights. While admitting the supreme importance of courage, we must also remember that boldness may be carried so far as to become mere folly. Most of the successes of extreme boldness have been won over troops or commanders of inferior quality. Against one's equals, to go on throwing dice loaded against one is to invite disaster. Any one of the successful audacities cited in the last paragraph might well have brought crushing defeat; the boundless daring of Charles XII of Sweden ended miserably; in 1812 Napoleon's decision to advance beyond Smolensk into the heart of Russia destroyed his Empire. On a smaller scale, in September 1777 Burgoyne's bold decision to cross the Hudson, cut his communications with Canada, and advance toward Albany brought about his surrender and so led to the French alliance which assured American independence. Had he succeeded he would have been praised to the sky. At the time, however, he knew that the spirit of the rebels was unbroken, he had as yet received little tory support, and he had no reason to expect a powerful coöperation from the British troops in New York City. If we ask how far we are to admire the determined gambler, and if we remember that Napoleon did not always obey his own precepts, we may take his saying: "There is no greater coward than I when drawing up a plan of campaign. When once my decision is made, I forget everything except what may carry it through to success." Although morale is indeed a most important part of war, nevertheless in the years before 1914 the French command greatly exaggerated its importance; forgetting that the physical side must also be considered, that no human courage will armor an unprotected man against bullets or resurrect a corpse. Prudence can never be more than the servant of courage; it should never be allowed to supersede its master, but it is often an indispensable servant.





Gas Defense

Our Civilian Population Should Know About It

By Fred. H. Wagner*

DESPITE all interdictions placed by the League of Nations on the use of poison gases, and the agreement signed by some thirty-three nations to make no use of this form of warfare, little confidence has been created in its abolishment. All major nations, with the exception of the United States, are preparing their civilian populations for gas attacks. It may be of interest to examine what these preparations are and what they are to combat.

It is reported that England, France, Germany and Italy are instructing their urban and rural civilians in the proper use of gas masks. It is also reported from some quarters that even hospital nurses and school teachers instruct their charges in this necessary protective measure. Germany is reported as going so far as to construct an exhibition house provided with a gas-proof cellar as a place of refuge during gas attacks. How the entire population is to be provided with such refuges is, however, quite a problem, since the gas-proof room is made in the form of a concrete box the bottom edges of which are supported in a deep trench which can be rapidly filled with water when an attack impends. Entrance is to be gained to this refuge by diving through the water and under the edge of the wall! It is expected that the water will protect the refugees from most of the poison gases, and possibly any germs. The refuge must, of course, be ventilated, but the manner of doing this has not been disclosed. In Denmark sufficient gas masks, it is reported, have been provided to equip all civilians, and these can be purchased from the government for about $5.00 each. The matter of providing schools and other large buildings with gas-proof rooms also is contemplated. Turkey has given instructions to city and town authorities to prepare (?) cellars where the civilians may find refuge, and it is reported that all civilians in Japan are being provided with gas masks. In Italy gas masks are under the control of the state, and the people are being instructed in their use.

The protection against gas as practiced by the Army should also be taught all civilians here in the United States, but persons not thoroughly conversant with this procedure should not be detailed as instructors. Sufficient knowledge has been gained by this time to impart some of it to the man on the street, and any protective measure provided must include both refuges and personal protection.

The International Gas Conference in Brussels divided the civilian populations into two classes, i.e. active and passive. The police, fire departments, physicians, nurses and sanitary employes compose the active class, and for them all sorts of protective equipment are prescribed. For the passive class, or the average citizen, there is to be a simpler means which will permit the populace to flee the poisoned zone and seek the protective refuge. Some states have already met these conditions, at least in part; others are of the opinion that individual protection for the citizen is *unnecessary* and that the protective refuge will suffice. The latter arrangement appears to be a doubtful one; it could no doubt be improved upon, especially in large cities and industrial centers, by providing each citizen in the danger zone with a gas mask.

THE United States are, however, at present provided with absolutely nothing which could assist in the preservation of civilian life in the event of a gas attack. In spite of the fact that mass destruction by gas from the air, especially as regards our cities, is rather far stretched, the attempt to thus break the public will is not to be disregarded. How the protective problem is to be met is highly controversial. During the air raids over London the people in the streets flocked for refuge into the subways, but in the case of a gas raid subways are the poorest haven of refuge imaginable. As seen in the gas characteristics cited below, the gases employed, being much heavier than air, all settle to the lower levels; consequently they invade subways or any other low-lying space. Under these conditions it would appear that the higher up one travels, the safer one would be; it has therefore been proposed that refuge be sought in the city's high buildings. But how many cities contain sufficient buildings of this character to accommodate its citizens? Besides, if the chemical planes are accompanied by bombing planes would not the high buildings be the logical points of attack for the bombers? It is also logical to think that in an air raid over a city the chemical planes would be the first in line, distributing their noxious gases for the purpose of thoroughly demoralizing the inhabitants, after which the actual physical depradation upon the city would follow. It would therefore appear that no large city can at present offer a safe refuge, hence the European idea of building gas-tight refuges. Instead of being simply ventilated, as suggested in Germany, these refuges would probably have to be supplied with compressed air or oxygen for breathing purposes, and unless this air could escape after becoming vitiated, life in such refuges would not be worth much. It appears to me that the only safe course would be the provision of gas masks accompanied by proper instructions as to how they should be used, and even this would not present a positive means of safety for all. The other alternative is an *air force of sufficient size* and antiaircraft equipment to repel the invader before he has an opportunity to drop destruction from the skies. It is highly questionable whether in the face of present day developments our Government should purchase all the planes necessary to secure safety in the air, but it is absolutely necessary that sufficient pilots be trained to man these planes when necessary, an operation which cannot be accomplished when war is at our door. Planes might be obtained in time but not pilots.

We can no longer look upon the two oceans as a barrier against such invasion. With the advent of the present-day airplane, and the plane of the future with its long flying radius, both our east and west coasts are subject to such attacks, as witnessed by the January flight of six Navy planes from San Francisco to Hawaii, a non-stop flight of 2,150 miles. Such long flights, however, are not necessary for a gas attack, since airplane-carrying submarines are no longer a dream, and they

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can release their destruction-dealing birds when only a few miles from the shore line. The Atlantic coast, with its highly important industrial centers not too far inland, and strung out along almost its entire length, is especially weak in protection against gas, bomb and incendiary attacks, and bombs of this character dropped in such manufacturing areas can do immeasurable damage within a very short period.

The people of the United States are being propagandized through some of the press, the so-called peace societies, and others—of admitted "radical" leaning—in an effort not only to avoid war, which effort is most certainly commendable, but also to prevent the maintenance of a proper national defense. These influences would bring us to a position of absolute helplessness in a war which many thinking people feel will, to a large extent, be an aërial war, and into which we may be drawn without desiring it. So I wish to call attention to the character of the gases and powders to which humanity may, under present conditions, be subjected and found wanting in defensive means. (Even while writing these words I find in my home city a luncheon being held under the combined auspices of a Committee on the Cause and Cure of War, the Council of Peace Agencies, the League of Nations Association and the Women's International League for Peace and Freedom, whatever the latter word may mean. All futile organizations if they expect to *abolish* wars. But such is the state of affairs today, hence among such associates my voice is as one in the wilderness, since what they have to say is as *argumentum ad ignorationem* because they are deaf to *audi alteram partem*. Should the horrors of a "new" war overcome us it will be these same societies, and others like them who must shoulder the responsibility for unpreparedness.)

THE gases which were used and which are commonly proposed today may be divided into four classes: 1) Tear gases, or lachrymators; 2) Nose and throat irritants, known as the Blue Cross group; 3) Suffocating gases, or the Green Cross group, and 4) Corrosive gases, or the Yellow Cross group.

1) Lachrymators.

a) *Bromoacetone:* This substance has a specific gravity of 1.6, a boiling point at 136.5° C., and a melting point at—54° C. One cubic foot of its vapor weighs 0.358 lb. at 20° C. (68° F.). The weight of vapor required to saturate one cubic foot of air at 50° F. is 32.78 grains. The endurance concentration, or the highest war concentration which a normal man can endure for one minute, is 0.000006 cubic foot of vapor per cubic foot of air, or 6 parts per million. Much lower concentrations of this gas, as well as of those described below, are sufficient to greatly reduce a man's working capacity or resistance.

b) *Brommethylethylketone:* Specific gravity 1.43; boiling point 133°–145° C.; weight per cubic foot of vapor 0.392 lb. at 20° C.; endurance concentration 0.000008 cu. ft. per cu. ft. of air or 8 parts per million.

c) *Bromobenzylcyanide:* Specific gravity 1.54; boiling point 232° C.; melting point 29° C.; weight per cu. ft. of vapor 0.5087 lb. at 20° C.; required to saturate one cu. ft. of air 0.328 grain at 68° F.; endurance concentration 0.0000037 cu. ft. per cu. ft. of air or 3.7 parts per million.

d) *Chloroacetophenone:* Specific gravity 1.32; boiling point 244.5° C.; melting point 58.5° C.; weight per cu. ft. of vapor 0.4011 lb. at 20° C.; required to saturate one cu. ft. of air 0.0459 grain at 68° F.; endurance concentration 0.0000007 cu. ft. per cu. ft. of air, or 0.7 part per million.

2) Nose and Throat Irritants (Blue Cross).

e) *Diphenylchlorarsine:* Specific gravity 1.4; boiling point 333° C.; melting point 38° C.; weight per cu. ft. of vapor 0.6867 lb. at 20° C.; required to saturate one cu. ft. of air 0.000153 grain at 68° F.; endurance concentration, in floating particles, 437 to 874 grains per 1,000,000 cu. ft. of air with particles from 1 to 10 microns diameter.

f) *Diphenylcanogenarsine:* Specific gravity 1.45; boiling point 346° C.; melting point 31.5° C.; weight per cu. ft. of vapor 0.6617 lb. at 20° C.; required to saturate one cu. ft. of air 0.0000437 grain at 68° F.; endurance concentration, in floating particles, 109 to 437 grains per 1,000,000 cu. ft. of air, depending upon size of particles.

g) *Diphenylaminechlorarsine (Adamsite):* Specific gravity 1.57; boiling point 410° C.; melting point 195° C.; weight per cu. ft. of vapor 0.7179 lb. at 20° C.; required to saturate one cubic foot of air 0.0000087 grain at 68° F.; endurance concentration same as (e).

3) Suffocating Substances. (Green Cross).

h) *Chlorine:* Specific gravity, gas 2.47 (air = 1) liquid 1.47 (water = 1); boiling point—33.6° C.; melting point—102° C.; weight per cu. ft. of vapor 0.1841 lb. at 20° C.; required to saturate one cu. ft. of air 0.000065 cu. ft.; endurance concentration 65 parts per million.

i) *Carbonylchloride (Phosgene):* Specific gravity 1.43; boiling point 8.2° C.; melting point—120° C.; weight per cu. ft. of vapor 0.2566 lb. at 20° C.; required to saturate one cu. ft. of air—Forms gas above 8.2° C.; endurance concentration more than 10 cu. ft. per 1,000,000 cu. ft. of air.

j) *Trichlormethylchloroformate:* Specific gravity 1.65; boiling point 127° C.; weight per cu. ft. 0.5138 lb. at 20° C.; required to saturate one cu. ft. of air 11.36 grains at 20° C.; endurance concentration: effect is somewhat greater than with phosgene.

k) *Chlorpicrin:* Specific gravity 1.66; boiling point 113° C.; melting point—69.2° C.; weight per cu. ft. 0.427 lb. at 20° C.; required to saturate one cu. ft. of air 26.2 grains at 0° C. and 126.8 grains at 20.5° C.; endurance concentration 0.000015 cu. ft. per cu. ft. of air, or 15 parts per million.

4) Corrosive Substances. (Yellow Cross.)

l) *Dichlordiethylsulfide (Mustard gas. Yperite):* Specific gravity 1.26; boiling point 215.5° C.; melting point 13.5° C.; weight per cu. ft. 0.4132 lb. at 20° C.; required to saturate one cu. ft. of air 0.1508 grain at 14° C., 0.1845 grain at 18° C., 0.2364 grain at 20.5° C., 0.3142 grain at 22° C., 1.3026 grain at 39° C.; endurance concentration: severe primary irritation appears only with very high or deadly concentrations.

m) *Ethyldichlorarsine:* Specific gravity 1.68; boiling point 156° C.; weight per cu. ft. 0.4544 lb. at 20° C.; required to saturate one cu. ft. of air 9.616 grains at 21.5° C.; endurance concentration 0.0000015 cu. ft. per cu. ft. of air, or 1.5 parts per million.

n) *Chlorvinyldichlorarsine. (Lewisite):* Specific gravity 1.9; boiling point 190° C.; melting point—13° C.; weight per cu. ft. 0.5387 lb. at 20° C.; required to saturate one cu. ft. of air 0.1726 grain at 20° C., 6.819 grain at 40° C.; endurance concentration, similar to (l).

o) *Methyldichlorarsine:* Specific gravity 1.84; boiling point 133° C.; weight per cu. ft. 0.4182 lb. at 20° C.; required to saturate one cu. ft. of air 32.783 grains at 68° F.; endurance concentration 0.0000037 cu. ft. per cu. ft. of air, or 3.7 parts per million.

WHILE all these substances are included under the general term "military gases," all are not gases. Some are vapors and others an impalpable powder or dust. Of these, phosgene and mustard gases were those most commonly employed during the World War. The color of phosgene near the ground is green, turning to yellow at higher elevations. The results of the liberation of phosgene were brought home to the civilian through the unfortunate accident at Hamburg, Germany, several years ago, when from a central point a poison cloud spread rapidly over a considerable area of the city. It has been estimated that this cloud of phosgene had a breadth of 170 feet at a distance of 330 feet from its source; this breadth increased to 350 feet at a distance of 660 feet, to one of one mile at a distance of 4,950 feet. The breadth of this cloud of phosgene at 9.5 miles from the source was estimated 10 miles.

The inhalation of chlorine, or compounds containing chlorine, destroys lung tissue. Chlorine is so rapid in producing the effect desired that it had to be abandoned during the World War: it could be detected too soon. This brought about the other chlorine products which are slower in action, hence slower in detection. The effects of all chlorine combinations are finally the same. The victim begins to cough, and this is followed by the gradual destruction of the lungs.

Mustard gas is more insidious than any of the others. It is not a gas, but a volatile liquid which, when cold, spreads over the terrain in a thin film; it adheres to shoes and clothing, being thus carried from place to place by the victim without knowledge of its contact until it begins to vaporize. The victim then becomes highly uncomfortable, followed by coughing and retching, which soon produces suffering. Mustard gas kills slowly, but surely, every substance which boasts of life.

The new gases proposed are too numerous to describe here, but among these we have hydrocyanic acid, which causes immediate death when present in even minute quantities, while the bromide and iodide of cyanogen are similar in their effects. Cyanogen and chloride compounds act upon the nervous system, finally causing paralysis.

The Blue Cross compounds, or irritants, include the dusts or fine powders mentioned above. They are direct nervous irritants, and during the World War the gas masks were unable to prevent penetration, with the result that the victim experienced such painful sneezing and nausea that his self-control deserted him and he tore off his mask and thus exposed himself to the Green and Yellow Cross vapors which were usually sent out in company with the irritants.

THIS is a short inventory of the poisonous substances man may have to combat during another war. By man I mean the civilian population more than the soldier in the trenches, because some enemy—despite all humane laws may set out to break the public will at the very beginning of hostilities. It is this possibility which indicates the danger confronting us unless preparation is made to provide means of safety should the enemy be successful in delivering these death-dealing agencies to the civilian population. What other substances will be showered on mankind remains hidden in the womb of time. All nations, it is logical to suppose, are bent upon improving their gas technique.

I said above that any instructors in combating a gas attack on the civilian population should be thoroughly acquainted with the means employed in armies so it may be well to examine what has been done and what may be contemplated in the future.

During the World War the gases were either liberated from containers into a wind which would carry them to the enemy, or they were delivered to the latter through the medium of shells fired by artillery or mine-throwers. There is no doubt that the methods employed during the war for prompt delivery to the enemy have been improved considerably since then, but what these newer methods are will probably be made known only when they announce themselves. In the meantime we do know that the Stokes and Livens mortars have been greatly improved for the purpose of spreading fogs and forwarding gas shells.

The Germans made their gas attack at Ypers by liberating the compressed chlorine from 85-lb. flasks or containers; since then lighter flasks weighing, with their contents, not more than 25 lbs. have been developed. This lighter container is more easily handled and is so constructed as to remove some of the old dangers to its handlers.

The development of toxic smokes, which were employed for the first time in the Champagne district in August, 1917, has proceeded in the form of candles, cubes and containers. Toxic smokes are today under better control than in those days. Russia, for example, produces toxic smoke from diphenylchlorarsine within tin containers, also in the form of cubes. The smoke cloud following upon ignition is expected to move toward the enemy lines through wind action. These Russian containers weigh 5.75 and 26.5 lbs. each. Russian regulations regarding their use state: "Should it be desired to cause only fatigue among the enemy forces, or to make the wearing of gas masks necessary, smoke of a concentration of 0.437 grain per 1,000 cubic feet should be sent out during the entire night. This requires the use of 13 to 16 toxic-smoke cubes or 10.5 lbs. of poison substance per minute per mile of front. The burning of the cubes need not be continuous; short intervals are allowable. Should it be desired to place the enemy out of action entirely by making the gas filter ineffective, from 100 to 140 grains per 1,000 cubic feet are required per mile of front at the enemy's line. With the toxic cubes 5,280 lbs. of cubes, equivalent to 1,584 lbs. of diphenylchlorarsine, is required per mile of enemy front. In the latter case the gas must be continuously forwarded for a period of 10 minutes with a normal wind velocity of 400 feet a minute. The gas is most effective at a distance of 1.25 miles from its source; the total compass of effectiveness is 9.5 miles. Service of the poison containers requires only a few trained chemists, and only one carrier is required for from 50 to 100 containers; this carrier also ignites the containers."

THE principal gas attacks would, no doubt, be delivered from the air. For this there are three methods of delivery, viz., gas bombs, liquid substance rain, and the production of clouds or fogs with or without the addition of lachrymators or poisonous substances.

The second of these methods is not, however, very practicable for use over cities except during a surprise attack at night by low-flying planes. If attempted from any considerable height the falling rain would be so widely distributed by prevailing air currents that it would be ineffective. Spraying, or rain, does however present a means for poisoning the terrain ahead of advancing troops, when towns, valleys, fields of growing grain, and the tops of trees may be saturated with mustard gas by planes during the night. In this case it is estimated that an average of 650 grains of mustard gas per square yard of area are necessary. This estimate calls for the employment of at least fifty airplanes, each carrying 5,000 lbs. of mustard gas to effectively cover an area of one square mile.

The use of gas bombs would also be highly effective, especially if they should contain an addition of a shell-bursting substance, and this also applies to fog-producing shells.

The Russian army regulations also describe other methods for poisoning the terrain, among which are handsprays and the chemical "fougasse" or mine. In the case of the handsprays the regulations prescribe apparatus strapped to the operator's back and consisting of a container, with pressure-producing means, and a length of hose. These are to be used only by trained chemical troops in low-lying scrub land, and they are highly efficient where the passage of vehicles is impossible. In the case of the chemical mines, usually containing mustard gas, the regulations prescribe how the mines

are to be placed in the terrain and exploded by means of electrically ignited fuses a short period before the appearance of the enemy, say from three to four hours. The area poisoned by one of these mines is estimated by the Russians to embrace about 335 square yards.

THE Russians also propose motorizing their chemical arm. The railroad right-of-way is to be thus sprinkled with poisonous substances from cars provided with tanks and pressure apparatus, while the vehicle roads are to receive the attention of motorized trucks. The right-of-way and the roads, with as much of the side terrain as can be reached, are to be sprinkled ahead of the enemy's advance while the cars or trucks are in transit. These latter methods are not new; they were attempted by the Allies during the World War. It was found that they possessed several disadvantages; they propose the poisoning of level, smooth surfaces, or surfaces from which the poisonous substance is quite rapidly dissipated; the advancing troops, protected against gas, can pass over these stretches and, finally, this poison, due to the open terrain, can be neutralized. However, given the necessary time, the motorized trucks are capable of poisoning quite a large area with some settling or semi-permanent substance which will dissipate but slowly.

The areas thus contaminated have quite a military value; if, for example, the area were covered with mustard gas, it would be impossible for the enemy to pass through without resorting to troublesome protective measures. If accompanied by animals these due to their sensitive skin, would be in more danger than the men. This naturally causes the advance either to slow down or to halt entirely. The defense, of course, feels a certain measure of security behind the poisoned area, because he is aware of the difficulty and time required by the enemy to neutralize the area, which necessitates the spreading of considerable quantities of chloride of lime over the affected terrain, estimated at about 300 grains minimum per square yard. This security may be quite deceptive because the poison barrier is not an unconditional one since the effectiveness of mustard gas usually becomes pronounced only after a period of about four hours. Consequently there is always the possibility of the enemy arriving before this period of "incubation" is complete and, even without body protection, to pass through the affected area and to carry on the fight. But he must win to live because he cannot return through the same area in which the poison has become effective in the meantime.

Such a mustard-gas area can be discovered through the sense of smell by anyone who has once been in contact with the gas. It is not an easy matter for those not acquainted with the poison, especially if the natural odor has been changed by the addition of a disguising substance. Such a change in the odor can hide the presence of mustard gas, but it can also conceal its absence; such an addition gas is termed "swindle" gas by the Germans. Although this addition gas may be entirely harmless, its presence has quite a psychological effect on advancing troops who have been instructed to beware of gas and to whom every strange odor in the terrain being crossed makes the marching troops feel rather uneasy. These conditions are made worse when the true gas and the pseudo gas are mixed or applied beside each other as, for example, a valley containing the pseudo gas and an adjoining forest saturated with mustard gas. Identification by the inexperienced is almost impossible under such conditions. The Russian regulations require that trained chemists accompany the first lines of the advancing troops.

Suggestions have also been made for combining battle-tanks with chemical warfare, a combination of two modern weapons which appear to me as a rather hazardous undertaking. Two possible cases are before us: first, the battle tank which is to lay a non-poisonous fog or smoke screen, and secondly, gas-tight tanks capable of passing through the poisoned area. The tank cannot be considered a gas distributor, since it is not suitable or available for that purpose. It is essentially a fire weapon, but it can be employed to lay a smoke screen or fog cloud. Even though it were deemed possible to add tear gas or poison smoke to the fog, this would be a rather doubtful procedure, because, in the first place, the tank requires the smoke or fog cloud to conceal its own progress as well as that of the infantry accompanying it, but not to physically blind the enemy. Thus the tank is surrounded by its own fog, and from British experience we learn that the non-poisonous SO_3-chlorosulfonic acid, which they employed to make the smoke or fog, necessitates that the men in the tanks wear masks. This was found highly disagreeable and tiring under the circumstances. It is, however, possible with a favorable wind to have the tank crew plant and ignite toxic candles, cubes or containers.

IN consideration of all the possibilities presented, it seems almost impossible to establish a thoroughly dependable defense against a gas attack from the sky. This has caused the presentation of all kinds of fantastic proposals for the protection of cities, even to the extent of building new cities of a character assumed to be safe against gas invasion. The city designed for this purpose would entail the erection of high buildings with considerable open spaces between them, the height being intended to provide a refuge against the heavy settling gases, while the area between the buildings is for the purpose of neutralizing the force occasioned by an explosion in a confined space. These proposals, however, hardly take into account the expense entailed in building such new cities.

Finally, to these gas menaces must be added the danger occasioned by incendiary bombs, as was witnessed in the city of Rheims upon the German retreat from its environs. A more recent example is the reported dropping of cans of gasoline over the Chapei district by the Japanese during the Chinese defense of Shanghai. These cans, of course, burst open when they hit the ground or other obstacle. The airmen then dropped an incendiary bomb which ignited the gasoline.

In closing this article I can only express the hope that our cities will never be exposed to such horrors, but in the meantime, and while we still have the opportunity, we should prepare for such an eventuality. It is actual mass suicide for our people to live in thoughtless or fancied security because our pacifists and others inform us that there can be no more wars. Preparedness should therefore be the nation's watchword, a watchword which false economy cannot abolish any more than man can abolish war under our supposed state of civilization. Even though some future disarmament conference should abolish *all* military weapons, both offensive and defensive, when the time should arrive to settle national quarrels long sentences and beautiful words will not remove the causes for the quarrel. In spite of the preaching of the Man of Peace for a period of nearly 2,000 years, the nature of man unfortunately remains the same. It will not then be altered by mere peaceful mouthings based on ignorance of the subject.

Infantry Weapons

The Study and Test of New Armament Developments

By Lieut. Col. R. H. Kelley*

THE development of military armament and equipment for military forces constitutes a record of evolution dating from earliest recorded history. Introduction of new weapons has forced changes from military formations in which men fought in close personal contact to present dispositions including great dispersion in width, depth, and in use of cover. Unexpected methods of attack have resulted in defeats of a surprised—often superior—enemy and thus have influenced the course of history. Developments in the military world covering both the offensive and defensive are constantly appearing. Modern transportation has made possible the movement and supply—therefore the existence—of great armies such as characterized the World War. The present century is responsible for aircraft, tanks, lethal gas, radio communication, effective use of automatic weapons. The range of firearms of all calibers has been increased. The Infantry rifle now carries nearly 3½ miles. Self-loading or semi-automatic weapons may soon replace the bolt-action rifles now standard in most armies. Defense against gas has countered the effectiveness of such agents. New weapons or means of protection invariably produce their own check-mate. Attack and defense, today as throughout history, tend toward an equilibrium. Few phases of human endeavor have aroused inventive genius to greater activity than the solution of military problems.

USING THE SERVICE RIFLE AS SUPPORT FOR THE BROWNING AUTOMATIC.

An improvisation for firing from high vegetation or against aircraft. The muzzle of the service rifle rests in a recess cut in the bipod head.

Development, test, acceptance, alteration and rejection of armament demands close teamwork between the Ordnance Department and that major combat arm—the Infantry. As a procuring and manufacturing service the Ordnance Department is charged with mechanical design, technical development and production of weapons for the Infantry. The latter as the using service usually specifies what is wanted and the general characteristics desired. Ordnance experts then evolve details of design and specify materials required. Working in full coöperation with Capt. Sidney H. Negrotto, Infantry, a test officer of the Department of Experiment, the Rock Island Arsenal is now providing for issue to the service a new machine gun mount fitted with the "all-purpose" cradle. This device will be standard for machine guns. During the past year foreign developments have been secured for test and study by the Ordnance Department. These include the remarkable Gerlich ultravelocity bullet; the Solothurn 20-mm. gun with its multiple-duty mount providing for all-around fire on moving targets in the air and on the ground; the Solothurn light machine gun, an effective weapon in which beauty of outline has been sacrificed to utility; the latest Hotchkiss machine gun and automatic rifle. All the above mentioned weapons are air cooled.

The Department of Experiment at the Infantry School is devoted to study and test of new developments in armament and equipment. Infantry weapons include the rifle, bayonet, grenades, automatic rifle, machine guns, light cannon, light mortar, tanks and their use in defense against tanks, machine guns and aircraft. Transportation is required for personnel, necessary food and water, an increasing quantity of arms and ammunition, varied impedimenta essential for maintaining the efficiency of personnel—a subject demanding careful study of latest developments in motor vehicles and use of animals.

THE Ordnance personnel at Fort Benning works at all times with the Department of Experiment. Maj. P. G. Blackmore, Capt. John Huling and Capt. A. H. Luse, all Ordnance Department, and the expert mechanics of the local ordnance shops give ready and expert assistance in making pilot models of various articles developed by the Department of Experiment and modifications found necessary in devices submitted for test. Included are an automatic rifle bipod and butt plate; a subcaliber device for the M2 37-mm. gun utilizing the barrel of the service rifle; a bracket permitting antiaircraft fire to be delivered from a tank; experimental attachments which have enabled the wartime light tank to be driven eight miles at full speed without overheating; duplication in solid brass of a 37-mm. shell and projectile containing a caliber .45 pistol barrel, a device designed to permit economical target practice both by howitzer companies and tank units; these few items selected at random from many projects result from close collaboration between the manufacturing and using services.

Campaign missions demand highest efficiency of the individual and of combat teams. Communications essential to security, information, control and direction of widely dispersed forces are developing compact efficient, portable telephones, telegraph and radio sets. Studies in equipment cover attempts to establish the load carried by the foot soldier at one-third his weight—the maximum burden considered possible without reducing his efficiency and activity. New

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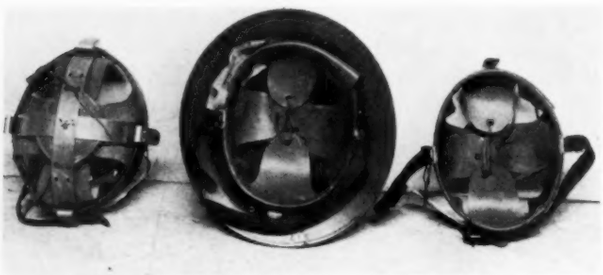
designs in campaign hats and steel helmets, a new helmet lining of aluminum and leather—now being manufactured in quantity, portable field stoves using gasoline as fuel, water proof clothing, cotton web harness, improved training methods, plans utilizing domestic materials to the maximum extent in manufacture of military equipment, new or improved weapons and ammunition, tests or armor and armor



Helmet Linings of Aluminum and Leather.
Adjustable to any head size and vermin proof.

resisting projectiles, gas defense, schemes to increase efficiency of equipment now in use—the projects under consideration and test by this Department cover a wide field. An infantry assault bridge developed by the Corps of Engineers is now being given service trials under varied severe conditions.

Tank development, a joint Ordnance Department and using service project, is producing an American armored vehicle of great speed on highway and across country, fire power, flexibility in maneuver. The weight and size of this infantry development is limited by practical demand for movement under its own power in any situation and also as freight by rail or truck. This in turn dictates the size and number of weapons carried, thickness of armor and weight of engine and body. Advantages of air-cooled engines demand consideration. Possessing speed, shock action and powerful armament, the tank is proving an offensive agent of increasing importance.

COMPLETE mechanization of the Army is enthusiastically urged by many careful students as demanded by modern conditions. Progress is being made in this direction as machines prove their suitability. Some writers on military subjects insist that modern warfare has been reduced essentially to conflicts between inanimate agencies in which the human element is secondary. But it must not be forgotten that man, the power behind the machine, is individually, physically, mentally, psychologically and collectively the same creature he was at the dawn of recorded history. He requires the same amount of food and rest, is subject to diseases identified as scourging armies in ancient times. He can still carry about fifty pounds without losing ability to march and to use weapons efficiently. Danger of individual or mass panics which has marked every war is not lessened when death may come from unseen or distant sources. Necessity for direction, control, discipline and leadership is, if anything, greater than ever before, in the world's history. Mechanization, improved weapons, mechanically controlled devices cannot replace the human element in military operations. Ordnance and Infantry developments in power-driven vehicles are progressing as fast as appropriations permit and—it is believed—along sound lines.

As all professions and trades tend to become international through travel, communication, conventions and widely translated technical publications, so military science is maintaining a most interesting and uniform level of efficiency throughout all modern armies. Military developments or inventions appearing in one country are promptly studied, adopted, adapted or rejected by the War Departments of other nations. Failure to keep informed may result in catastrophies affecting the lives, welfare, even the existence of peoples and governments.

Study of foreign ordnance development is essential. New weapons and apparatus designed to increase efficiency of military organizations—and of the individual soldier—have appeared at intervals throughout history. Some recognized as original and revolutionary include the saddle, firearms, aircraft.

PROGRESS and efficiency demand that production of new, improvement in old armament and matériel be encouraged. Economy requires conservation in scrapping existing serviceable equipment. Common sense dictates study of devices produced; practical tests to determine value; decision to adopt, adapt or reject. Consistent with traditional military policy the U. S. Army is limited in strength and appropriations—but our great industrial nation expects its military forces to be second to none in efficiency of personnel and matériel.

The Department of Experiment at the Infantry School is devoted to study of weapons and equipment intended for use of the Infantry and to determining the service value of projects submitted. These cover a wide field—weapons, clothing,

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transportation, cooking devices, night firing, tanks, defense against aircraft, etc. Combat units stationed at Fort Benning are utilized for practical service tests simulating conditions expected in actual service. Suitable weapons and equipment are essential to success in action. Technical tests are given new armament at the Ordnance arsenals. Service tests are a function of the using service. Both coöperate to insure adoption of most suitable equipment.

Lack of peacetime preparation is accused of making the wars in which this country has been engaged unnecessarily expensive in lives, time and treasure. The work of this Department constitutes an effort of the Infantry and the War Department to keep informed of new developments in training methods, weapons and matériel, to study new inventions, to improve equipment. No alibi is accepted from the military for ignorance with regard to existing or available means of attack or defense after an emergency appears. Progress results from dissatisfaction. Maintenance of the *status quo* in the military world is as impossible today as in the past.

A Chronicle of Ordnance

The Place of Explosives in the Annals of Defense

By Aiken Simons*

IN his early tribal fights and in the beginning of historical warfare man fought on foot. Even after the horse was domesticated and used for the transportation of man and burdens, the lack of a suitable saddle with stirrups prevented the effective use of mounted men since in a melée a stirrupless horseman might be pulled off and killed by foot folk. Since, however, the art of war depended mainly on the cutting and stabbing effect of hand arms actuated by the muscular power of the individual, any increase of this force by the added speed and weight of the horse added to the power of a strong man and made a relatively weak mounted man the superior of a muscular man on foot.

Effective cavalry may be said to have begun with the development of stirrups somewhere in the first century of this era and reached its flower about the time of the first use of firearms in battle which marks the beginning of the infantry period, although at first progress was very slow, somewhat due to the contempt in which the foot folk were held. The Spanish word *peon*—meaning peasant, or low fellow—means one who goes on foot, an infantry man or a pawn.

The date of the first use of explosives in war is somewhat difficult to establish to a certainty since many claims of extreme antiquity have been put forward in behalf of the Chinese, Hindus, Arabs, Greeks and others. Lt. Col. Henry W. L. Hime of the British Royal Artillery has examined all these claims in a very learned book "The Origin of Artillery" which quotes numerous documents in the original Latin, Arabic and other languages and is of the opinion that Friar Bacon, an Englishman, was aware of the properties of gunpowder before the year 1249. Without guns, powder would be of no use and most authorities agree that guns were invented by Berchtold Schwarz, a German Franciscan Monk, in 1313. In 1324 when the King of Bohemia attacked Metz, the citizens possessed firearms which were of notable and recorded value in repulsing the assailants. Guns were placed aboard English ships of war in 1338 and were used rather ineffectually two years later at the battle of Sluys when the French were defeated by the skill of the English archers and mariners. The English had three large guns at Cressy in 1346 and their moral and physical effect had much to do with the overwhelming defeat of the French, although no details of these guns are now extant.

Friar Bacon's proportions for gunpowder were in the following percentages: saltpeter 41.2, charcoal 29.4, sulphur 29.4, and even as late as 1350, Dr. John Arderne of Newark, England, employed 66.7 saltpeter, 22.2 charcoal, 11.1 sulphur, which formula is low in the oxygen-carrying saltpeter and high in combustibles. In addition to this defect, the saltpeter was generally very impure and the powder was a crude mixture of the ingredients which tended to settle out according to their relative weights, the charcoal on top. This resulted in low pressure, low velocity and great fouling of the firearm.

In 1336 the *Service des Poudres,* or government powder monopoly of France, had its beginning, Pierre de Gallart, Grand Master of the Crossbowmen and chief military officer of the kingdom after the two marshals, took charge of the war machines even then called artillery, forbidding the manufacture of powder except in such places and in such ways as were approved. This had the effect of improving both the guns and the powder, so that in 1428 when the English besieged Orleans they had fewer guns than had the town and such guns as they had were ill served. There were 70 guns in the town and 12 master gunners to direct the service. About this time the practice of corning and glazing powder came into usage and it was noted that two pounds of corned powder did as much work as three pounds of meal or "Serpentine" powder. Corned powder was limited for a long time to use in small arms as it was considered too strong for the artillery of the period.

IN 1453 an enormous Turkish Army, the size of which cannot be ascertained, besieged Constantinople, whose garrison of 9,000 had to hold a combined land and sea front of 39,000 yards. So strong were the walls that the besieged held out for 55 days. The town fell only when the Turks entered through a breach made by three guns which, according to Leonard de Chio, Archbishop of Mitilene, who was present at the siege, threw stone balls 28 inches in diameter, weighing about 1,100 lbs. The guns had an extreme range of a mile with a penetration of six feet of earth at this range. There were no gun carriages so the guns were propped up with stones and wood, and hence had to be reset after each discharge which limited their rate of fire to seven rounds per day or one per night. For transport they were rolled sideways along the ground about the axis of the bore. Two of these stone cannon balls are now at the U. S. Naval Home at Philadelphia.

When Charles VIII of France invaded Italy in 1494 he had a total force of 50,000 men with 140 great cannon and a number of smaller ones or one large gun to 357 effectives. These guns enabled him to take any city which closed its gates. A few years later in 1515, Francis I assembled an army of 38,000 infantry with 370 guns which defeated the Swiss at Marignano, or one gun to 103 effectives. This artillery in which the famous Chevalier Bayard served as a lieutenant was very largely responsible for the victory. Not only were guns used in direct fire but at the siege of Mezieres in 1521, mortars and bombs were used for the first time and fired 5,000 projectiles into the town. French victories at Ravena, Metz and elsewhere are ascribed to the superiority of their artillery in numbers, in type and in training. Francis I made the Grand Master of Artillery one of the most important officers of the kingdom. Thus artillery had taken from the mail-clad knight the complete control of the battlefield, but the artillery sadly lacked *mobility,* the heavy guns, sometimes drawn by oxen and conducted by hired teamsters, frequently failed in *direction* and *concentration.*

Charles VII and Francis I had both tried to create satisfactory infantry but the stigma which attached to a man who traveled or fought on foot was too strong to be overcome.

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In many languages the word to indicate a man of good birth and breeding is the equivalent of horseman: "Ritter," "Caballero," "Chevalier" are examples. The Spanish, to overcome this prejudice raised a regiment of foot folk over which a royal prince (*Infante*) was appointed Colonel General, giving it the title of *Regimiento del Infante* or more concisely *"Infanteria,"* whence comes the word infantry in most languages. Not alone did the stigma of low origin delay the development of effective foot folk but the question of arms had yet to be solved. The pike was the principal weapon with perhaps a few musketeers at the corners of the unwieldy solid squares of men, sometimes 16 ranks in depth.

GUSTAVUS ADOLPHUS of Sweden, in about 1630, was the first commander to realize the value of infantry fire power and to improve its rapidity and accuracy. He introduced the wheel-lock musket of a shorter and lighter model which could be fired without a forked rest. However, a number of pikemen were still essential to protect the musketeers against cavalry charges. Gustavus also developed a light four-pounder which could be moved by one horse or four men and which was fired even more rapidly than the musket, using fixed ammunition of a light wooden powder case, to which the ball was fastened by wire. Gustavus is to be credited with the appointment of regimental surgeons, the introduction of a standard uniform and of a regular supply system of food, munitions, and equipment, forwarded from established depots which enabled him to occupy districts which could not of themselves supply his armies. It is probable that Gustavus got his idea of a very mobile artillery from Henry IV of France who in 1589 mounted some of his smaller culverins on wheels in such a way that they could be drawn by several horses and keep up with the rapid movements of his army. The small-arms cartridge of paper or linen was known to the English in 1560 but had not been put to any systematic use. The death of Gustavus in 1632 and of his great rival, Wallenstein, two years later had no effect to terminate the "Thirty Years War" which dragged on until 1648. However, no developments of note occurred. It is interesting, however, that Wallenstein realized the importance of sea power and urged the Emperor to keep a fleet in the Baltic to prevent the Swedes and Danes attacking the northern ports of the Empire.

The work of Francois Michel le Tellier, Marquis de Louvois, the great war minister of Louis XIV, and of Le Prestre de Vauban, the greatest of military engineers, is so closely connected both as to time and result that these two may be considered together. The reform of the French army by Louvois began in 1666 when he became Minister of War and includes the foundation of the artillery schools at Douai, Metz and Strasburg; the creation of the corps of engineers, the establishment of regimental uniforms, the foundation of companies of cadets to train officers, the regulation of the march, the substitution of bayonets for pikes, the collection of commissary and ordnance stores and their issue in an orderly manner, the promulgation of regulations and the enforcement of discipline. The belief in the superior caste of mounted men was still prevalent, to counteract which Louvois prevailed on Louis XIV to issue an edict that no officer would be commissioned in the cavalry until he had served in the infantry.

Vauban, for whom St. Simons invented the title of "patriot," was the first of engineers both in the sense of time and of eminence. A partial list of his accomplishments is as follows: The invention of the socket bayonet which enabled the piece to be fired with the bayonet fixed, the use of shells to destroy earthworks, the invention of parallels to sap a besieged place, the construction of 32 new fortresses and the improvement of 300 old ones, the conduct of 53 sieges, the participation in 140 pitched battles, the construction of the harbors at Antibes and Toulon, as well as numerous canals, roads, etc. He also drew up plans for economic reforms, religious toleration, and equitable taxation, but the King in 1707 condemned the plans to the pillory and Vauban died soon after.

Marshall Saxe and Frederick the Great are so closely contemporaneous that they may be considered together, especially since both of them were more tacticians than ordnance designers. To Marshall Saxe is due the idea of a light, long-range infantry-accompanying gun and rifled breech loaders for infantry as well as the tactical idea of a self-contained unit of all arms, which he called the legion, or what is today called a division. To Frederick the Great are due the ideas of rigid discipline, perfect drill, and a general staff. His one contribution to material seems to be the iron ramrod which permitted the piece to be loaded from any position, thus permitting the infantryman to lie flat or take advantage of any natural or artificial cover.

About this period the development of a real corps of artillery had become effective. In early times the drivers were hired civilian teamsters who were neither trusted nor respected and even cannoneers were much looked down on. Cromwell seems to have done much to organize his artillery and even had the infantry support a permanent part of the artillery corps since he armed these supports with flintlock muskets or "fusils," the match lock with which other infantry was armed being considered too dangerous around the barrels of loose powder from which the cannon were loaded. The French developed this idea still further by making one complete arm of cannoneer, driver and supports. Thus with the perfection of a lighter piece on a practical carriage by Gribeauval in 1774, artillery had reached a standard which remained unchanged by the American Revolution, the Napoleonic Wars and for some 20 or 30 years into the nineteenth century.

THE American Revolution developed only one material improvement which was the use of the rifle in the hands of trained marksmen who could take advantage of natural or hastily prepared cover and decimate the compact ranks of opposing infantry as at Saratoga, Kings Mountain and Cowpens. During the siege of Gibraltar, 1779-1783, the English found no way of attacking the Spanish working parties in trenches beyond the range of case shot; as a makeshift, Captain Mercier of the British Army suggested firing 5.5-inch mortar shells in the 24-pounder long guns which had the same caliber as the mortar, i. e., 5.8-inches. This was done and the execution among the enemy ranks warranted its adoption. After the war, Lieut. Henry Shrapnel of the Royal Artillery, devised a plan of what he called "spherical case" where the bursting charge was only enough to rupture the container. This, however, was not tested or adopted until 1803.

The wars of the French Revolution and the Napoleonic Wars produced nothing of note in munitions, but were noteworthy in the coöperation of the French nation in producing munitions, especially saltpeter, for powder manufacture. Owing to the English control of the sea, saltpeter could not be brought from India, so "niter farms" were installed all over the country where animal refuse was mixed with wood

ashes, plaster, etc.; 16,000,000 lbs. of saltpeter were produced in one year. But the process could not compete with importation when peace returned. By this time, the flintlock or fusil had entirely superseded the matchlock. The word *fusil* is a French corruption of the Italian *focile* meaning flint or firestone. In 1800 the 95th Regiment of Infantry in the British Army were issued the Baker muzzle-loading flintlock rifle, caliber .65-inch with a rod 30½-inch barrel. This development was due to experience in the American Revolution.

UP to this time, no percussion weapons had been made, although fulminate of gold had been experimented with in 1663. Fulminate of silver had been discovered by Bertolet about 1790, and fulminate of mercury by Howard in 1800. The Rev. Alexander Forsythe, a Scotch clergyman, took out a patent in 1807 for the percussion principle, but not the cap. He mentions in his patent the use of chlorate of potash and fulminating metallic compounds either single, mixed or in further compounds. The percussion cap was invented in 1816 by Joshua Shaw, an Englishman settled in America. In 1840, smooth-bore percussion muskets were issued to the French Army, followed closely by the American on January 20, 1841. The British Army commenced to change in 1842, but the process was slow and not complete in 1853 when an entire rearmament with the Enfield rifle occurred.

The Crimean War, 1854-6, was the last war fought entirely with muzzle-loading small arms, although they were in the preponderance in the War of Secession in America. The Colt's revolver was first manufactured in 1836, but was only used by individual officers until the War of Secession.

In the meantime the new factor of the steam railroad was making itself felt in war. While not a munition, its effect on supply and troop movement had a similar influence. In 1830 as an experiment a British regiment was moved at the unprecedented rate of 34 miles in two hours. In 1833, Hurkort, a German, proposed a railway and telegraph line along the right bank of the Rhine from Mainz to Wesel as a certain method of defense against the French; but the then prevalent military opinion was that infantry could march faster and that it was impossible to transport cavalry or artillery by train. However, in 1846 the British War Office issued a regulation on military transportation by rail. In the same year the Prussians moved 12,000 men over two lines. In 1850 the Austrians moved 75,000 men, 8,000 horses and 1,000 wagons from the Danube to Silesian frontier, thus overawing Prussia at Olmutz.

Field artillery in the meantime had progressed but little. However, Louis Napoleon Bonaparte had been a militia officer in the Swiss Army and later on when imprisoned at Ham for his attempts at the French throne, had diverted himself by writing an historical and critical work on artillery. When he became Prince-President and later Emperor of the French, artillery still interested him. There had been attempts to produce rifled field pieces by Robins, 1745, followed by many others without practical results. The Emperor Napoleon III asserted that the tedious siege of Sebastopol had in a large measure been due to the inadequacy of the smooth-bore guns and in 1854 directed that experiments be made with rifled guns. Some brass rifled guns were produced which were tried in Algeria and Cochin-China, and based on improvements suggested by these field tests, the French manufactured the field guns which played havoc with the Austrians at the battles of Magenta and Solferino, June 4 and 24, 1859.

ON April 12, 1861, the Confederate batteries in Charleston Harbor opened fire on Fort Sumter, held by a small garrison of U. S. Artillery, thus precipitating the War of Secession, which was to revolutionize both land and naval material and tactics. In no other way was this more true than in vessels of war. Armored floating batteries had been used with some success by the French and Spaniards at the Siege of Gibraltar in 1780 but without steam motive power such batteries were of little use, since the masts and rigging could be destroyed and batteries rendered immobile. Steam paddlewheel vessels had been used in England in 1802 and America in 1807, but the paddlewheel type was too vulnerable to be of great military value. The invention of the screw propeller in 1836 made steam war vessels practical. The British ship RATTLER of 880 tons was laid down in 1841 and U. S. S. PRINCETON in 1842. Both were wooden ships.

In the attack on the Russian forts at Kinburn on the Black Sea in 1855, the French used three ironclad floating batteries with such success that Great Britain and France constructed armored steam frigates. At the reduction of Fort Sumter the Confederates used a floating battery armored with two layers of railroad iron which was not damaged by the 32-pounder spherical balls at a range of about 1,700 yards. This battery was not self-propelled, being moved by a steam tug.

When the Norfolk Navy Yard was evacuated and burned by the U. S. Navy, U. S. S. MERRIMAC partially burned and then sunk, fell into the hands of the Confederates who cut her down to the berth deck and built a sort of mansard of oak and pine 24 inches thick from the water line to a height of 7 feet along 170 feet of the midship section. This mansard, with rounded ends, was covered with two layers of 2-inch wrought iron plates. Her armament consisted of two 7-inch rifles forward and aft, two 6-inch rifles and six 9-inch smooth bores in broadside, 10 guns in all. Her engines and boilers were those which had been in before the fire and sinking and were poor, capable of driving her at only five knots. She drew 21 to 22 feet of water and was equipped with a submerged cast iron ram. The building of this ship, renamed C. S. S. VIRGINIA, was reported in Washington, where it caused such concern that the Navy called for bids for "ironclad steam batteries" for prompt delivery.

John Ericsson was awarded a contract and produced his MONITOR in 100 days from the laying of the keel. Launched on January 30, 1862, she put to sea from New York on March 6th, arriving at Hampton Roads March 8th. The MONITOR had a free board of about 2 feet, was 172 feet long by 41 feet beam on deck, and drew 10 feet of water. The deck plating appears to have been 1-inch wrought iron and side plating at water line 4 inches of iron. The turret, 20 feet in diameter by 9 feet above deck, armored with 8 layers of 1-inch plate, contained the armament, consisting of two 11-inch smooth-bore guns. The MONITOR, on arriving at Hampton Roads, witnessed the final destruction of the wooden ships CUMBERLAND and CONGRESS, and on the following morning her drawn battle with the VIRGINIA saved the rest of the wooden ships from flight or destruction.

The effect of the events at Hampton Roads was world-wide and enormous. The *London Times* said: "Whereas England had available for immediate purposes 149 first-class warships, she now has two, these two being the WARRIOR and the IRONSIDES." The day of the wooden ship had passed.

A few months later C. S. S. VIRGINIA was destroyed by the Confederates when her base, Norfolk, was evacuated, her

draught being too great to enable her to retire up the James River. Before the year was over, U. S. S. MONITOR sank in a storm off Hatteras. It is of interest that the ships which changed naval warfare were in existence for less than a year, although neither could be seriously hurt by any guns then in existence. The U. S. Government built many more ironclads of both the turret and the casemate types while the limited resources of the Confederacy permitted the construction of relatively few of the casemate type. All European countries immediately started construction of ironclads whose design included the ram bow of the VIRGINIA, which idea prevailed until the first decade of the present century.

THE weight and velocity of projectiles developed before or during this war rendered masonry forts valueless as shown by the effect of fire on Fort Sumter in the various bombardments and the reduction of Fort Pulaski, in front of Savannah, by a bombardment of only 30 hours. Only earth works were able to resist such fire. Submarine mines had been designed by Emanuel Nobel, who in 1842 destroyed a ship experimentally in the presence of Prince Michel of Russia. During the Crimean War, Nobel was commissioned to defend the harbor of Cronstat at the mouth of the Neva with mines charged with guncotton. This was known to the Allies with the effect that the English fleet commander decided not to press the attack on the point.

The national policy as well as the limited numbers and resources of the Confederacy dictated a defensive attitude which gave added value to submarine mines as a defense of the harbors and rivers. Some of the mines were quite primitive such as the one which sank U. S. S. CAIRO (512 tons, 3 guns) in the Yazoo River on December 12, 1864. This mine consisted of a 5-gallon glass demijohn full of black powder, operated by a wire connected to an artillery friction primer; none the less the CAIRO sank completely in twelve minutes. The more complicated ones operated by electricity sometimes failed to act due to the faulty insulation of the wires and weak electric currents then available, as for instance when U. S. S. NEW IRONSIDES was directly over such a mine in Charleston harbor on April 7, 1863.

Submarine vessels to sink enemy ships had been considered during the American Revolution and the Napoleonic Wars but if any were constructed they failed to achieve material results. Horace L. Hunley of New Orleans, Louisiana, designed and had built a submarine boat (C. S. S. HUNLEY) which is described by General Beauregard: "It was shaped like a fish, made of galvanized iron, was 20 feet long, and at the middle 3½ feet wide and 5 feet deep. From its shape it came to be known as the 'fish torpedoboat.' Propelled by a screw worked from the inside by seven or eight men, it was so contrived that it could be submerged and worked under water for several hours, and to this end was provided with a fin on each side, worked also from the interior. By depressing the points of these fins the boat, when in motion, was made to descend and by elevating them it was made to rise. Light was afforded through the means of bull's eyes placed in the manholes." This craft is said to have made 3 to 5 knots an hour without severe exertion on the part of the crew. Her method of attack was to tow her torpedo by a rope, dive under her victim, rise to the surface beyond and cause the towed torpedo to make contact with the side of the vessel attacked. More than thirty men were drowned in experimental voyages but others volunteered and finally a successful attack sank U. S. S. HOUSATONIC (1,240 tons, 14 guns) in the harbor of Charleston, S. C., on February 17, 1864. On this occasion she carried the torpedo on a spar projecting forward. The HUNLEY never returned from the attack and all of the crew were lost.

In addition to this type of hand-propelled submarine, the Confederate Navy developed a steam-driven torpedo boat of spindle shape, 30 feet long with a circular cross-section 5 feet 6 inches diameter amidships, ballasted so as to float deeply in the water. The torpedo was a copper cylinder containing about 100 pounds of rifle powder carried on a hollow iron shaft projecting about 14 feet from the bow of the boat. With one of these boats, C. S. S. DAVID, Commander Glassell attacked U. S. S. NEW IRONSIDES off Charleston harbor on the night of October 5-6, 1863. While no great material damage was done, the effect on the morale of the blockading fleet was very great and Admiral Dahlgren commented in his diary "Nothing could have been more successful as a first effort, and it will place the torpedo among certain offensive means." In addition to the destructive effect on the morale of the Navy, Confederate mines, torpedoes and submarines sank 18 U. S. vessels mounting 98 guns and totaling 10,479 tons, with a loss of life of 220. Other vessels were damaged but not destroyed.

ALTHOUGH Marshal Saxe in 1730 had advised a rifled breech loader as the proper arm for infantry, nothing was done, largely because the mechanical methods available could not produce a satisfactory gun, especially a gas-tight breech. The metallic cartridge case solved this difficulty and the idea of interchangeable standard parts as developed by Hall and Colt made uniformity of chamber and bore a fact. The report of the Chief of Ordnance, U. S. Army, of October 1866 indicates that for the period of 1861-1866 the U. S. Ordnance Department purchased or manufactured 3,104,184 carbines and muskets of which about 281,000 were breech-loading and about 114,000 were repeating, thus only 13 per cent were other than muzzle-loading and the vast majority of these were carbines for the Cavalry. What value these breech loaders had in actual combat was debated and debatable.

The Confederate Government lacked machine shop equipment and adequate skilled mechanics to make breech-loading arms and metallic ammunition. Hence all made or purchased were muzzle-loading with the exception of some Sharps carbines made at Richmond by S. G. Robinson in 1862 and 1863 and a few Perry carbines made at unknown southern factories. Both of these used a paper or cloth cartridge similar to the muzzle-loader cartridge. There is a record that L. Morse, who had a shop near Augusta, Georgia, made a few breech-loading rimfire carbines but no record can be found of their issue to troops. When the Confederate Army captured breech-loaders requiring metallic ammunition, they modified them into muzzle-loaders.

There was much discussion regarding the relative merits of muzzle-loaders, breech-loaders, and repeaters; the proponents of muzzle-loaders claiming that a man so armed would aim more carefully since he knew it would take him longer to reload and that a man armed with a breech-loader would waste ammunition. In view of the fact that there was practically no musketry instruction and no target practice other than that offered by the old guard discharging their pieces when going off duty so as not to take loaded arms into camp or barracks, the opinion probably had a real foundation in experience.

The effect of the belief that the enemy had a breech-loader was detrimental to the morale of attacking troops. For example, "A Century of Guns," London 1902, in discussing the Spencer carbine said: "This rifle did terrible execution; at Balls Bluff, Virginia (October 21, 1861), one regiment of Confederates was armed with it, and to them was due the frightful slaughters of that bloody field." The Confederate troops on this occasion were 17th Mississippi, 18th Mississippi, 8th Virginia, 13th Mississippi and three companies of Virginia Cavalry. No record can be found that any of these troops had any breech-loaders or repeaters. Their fire from a wooded height was accurate and quick. The imagination of the enemy provided the Spencer repeaters.

At the close of the war a board was appointed to consider re-arming the U. S. Army and the findings of this board are published in the Report of the Chief of Ordnance for the fiscal year ending June 30, 1866. After a great deal of detailed work, the board reported in favor of caliber .45 as giving the best results in accuracy, penetration and range and endorsed the plan of altering the muzzle-loaders submitted by H. Berdan. The 6th finding of the board in reference to magazine carbines is as follows:

"6th. The board is not decided in the opinion whether it would be best to have only magazine carbines in the cavalry service. From past experience the board would be unwilling to dispense entirely with magazine arms, and as these arms can be used ordinarily as single-loaders, (retaining a number of charges in the magazine for extraordinary occasions, free from danger of ignition in the ordinary use of the gun) the only objections to their exclusive use are the additional expense of this arm over the simple single loader, and the greater inconvenience of the use of a lever-gun compared with some patterns of the hinge breech-gun which have been presented to the board."

The Chief of Ordnance in passing on the findings of this board recommended that the caliber should not be reduced below .50-inch as this would make the cartridge entirely too long in order to contain the proper weight of powder. The indorsement of Lieut. General Grant leaves the question of caliber in doubt, but it should be noted that it was finally adopted as .45-inch.

THIS war did serve to bring the repeater into prominent notice. Its use was considered by several nations but had not been adopted by any when the Franco-Prussian War broke out in 1870. As pointed out above, well-aimed fire on the part of defending forces gives the repulsed attack an erroneous idea of the equipment of the enemy. The second battalion of 61st Prussian Infantry attacked a group of French volunteers, partizans and *francs-tireurs* in stone buildings at Pouilly, near Dijon, on January 23, 1871, and were repulsed with slaughter, losing a flag. The Germans attributed their repulse to the use of repeating rifles by the French, but a detailed roster of the French troops indicated that there were some old breech-loaders, some Chassepot rifles and the rest muzzle-loaders, but no repeating rifles.

The first Winchester repeater, Model 1866, was a practical piece with a rapid rate of fire and reasonably rugged construction. The Turks had 30,000 of these in the war with Russia in 1877 together with 500,000 single-shot breech-loading Peabody rifles and Martini rifles. To the Winchesters has been attributed the bloody repulses of the Russians at Plevna, but no absolute verification of this can be found. Generally speaking, the under-lever type of repeater is not sufficiently rugged for military weapons, all of which developed on the bolt-action breech.

IN this connection it is of interest to consider the rate of fire of small arms at various times. It is a matter of opinion at what rate aimed fire can be delivered and the tendency seems to be to give too high a figure, since records are more apt to be kept of an exceptional case on the occasion of the test of a new fire arm, the performance of very well trained troops, or of an individual of more than normal skill.

The musketeer before the adoption of paper cartridges could fire a shot every two or three minutes and, in order to get any continuous fire, ranks were six or more deep. Gustavus Adolphus with the aid of the paper cartridge and a definite manual of loading which comprised over 90 motions, trained his infantry to deliver one shot per minute per man and reduced the depth to three ranks, which remained customary until about 1812, when it was reduced to two deep. The flintlock guns of the XVIIIth Century had an output of two shots per minute. The percussion musket of 1840 had about the same rate. The early breech-loaders such as the Prussian Dreyse or the French Chassepot brought the rate up to five shots per minute. The repeating rifles of 1875 used by average soldiers could fire perhaps nine or ten shots per minute. The most recent clip loading rifles have increased this to say twelve.

The increased rate of fire of each individual has resulted in a decreased number of men per unit of front so that the shots per yard have not increased in proportion to the rate of fire. Although the normal expenditure of ammunition has increased enormously, the number of shots to effect a casualty has remained about the same, notwithstanding the increased accuracy and range of the weapon. Statistics on shots fired to effect a casualty are limited and of doubtful accuracy, but the following are interesting.

At the Battle of Chickamauga, the Federal troops inflicted losses on the Confederates on a ratio of one casualty for every 204 shots fired. It should be noted that the fighting took place between veteran troops in heavy masses at short range and over long periods of time. In the Franco-German War

CHARACTERISTICS OF U. S. ARMY RIFLES DURING THE LAST HUNDRED YEARS

	Bore Ins.	Effective Range in Yards		Cost	
		Combat	Collective Fire	Of Arm	Per M Rounds
Flintlock pattern 1840	.69	75	75	$17.50	$12.00
Percussion Rifle 1861	.58	150	300	20.00	16.25
Springfield B. L. Rifle Model 1884	.45	300	1500	13.12	18.50
Krag Repeating Rifle Model 1898	.30	400	2500	13.72	25.56
Springfield Model '03	.30	500	2800	28.85	42.00

of 1870, at the Battle of Mars la Tour, the 38th Brigade of German Infantry suffered casualties at the ratio of one for every 760 shots fired by the French. On August 17, 1870, the French 25th Regiment of Infantry of the Line, while in front of Metz, had only 30 rounds of ammunition per man when attacked by the "Franz" Regiment and Third Guard Regiment. The Germans were repulsed with great loss, suffering 2,160 casualties or at the rate of one casualty for every 11 shots fired by the French. During the second Afgan War, the English at the Battle of Deh Sarak, March 1879, fired 28,000 rounds at ranges under 400 yards to kill 50 Afgans, although it is possible that some of the wounded escaped. This is in the ratio of one casualty for every 560 shots fired.

BLACK powder used alike as a propellant and a bursting charge had many disadvantages: it was very susceptible to the influence of moisture, an extreme incident of which is given by Marbot, who relates that at the Battle of Katzbach in the Napoleonic Wars a heavy rain storm occurred. A body of Prussian infantry formed square which could not be broken by charges of French cavalry, whose horses reared at the bayonets. On the other hand, neither side could fire their flintlocks because of wet priming charges, so that the battle remained bloodless until the French brought up Polish lancers, who charged and broke the square, permitting the infantry to be sabered by the cavalry. Black powder left a heavy residue in the bore, about half of the products of combustion being solid; although some of this is carried out by the blast of the discharge, enough remained to render the loading of a muzzle-loader difficult. A sergeant of the 25th South Carolina Infantry reports that at the Battle of Second Cold Harbor, May 31, 1864, he used up two Enfield rifles, which became so foul that it was impossible to ram home the bullet.

The solids carried out by the blast of the firearm formed a curtain of acrid smoke which obscured the field and rendered intelligent tactical disposition of troops impossible. Finally, the development of armor-plated vessels brought about a dead-lock, since black powder, where half of the products of combustion are solid, did not develop a sufficient volume of elastic gas to impart a high enough muzzle velocity to the projectile to penetrate or shatter the armor.

The discovery of guncotton in 1845-1846 by Prof. C. F. Schönbein at Basle gave great hopes that the above difficulties had been overcome. Schönbein went to England, took out patents for his invention, gave successful demonstrations before the British Navy and Army and leased the right to manufacture to John Hall & Sons of Faversham. An explosion on July 14, 1847, destroyed the Faversham plant and killed twenty-one men. Similar disasters in France, Austria and elsewhere discouraged further attempts with this substance.

Schönbein's discovery came to the notice of the U. S. Government, who instructed Maj. Alfred Mordecai to make experiments comparing guncotton with the black powder then standard. A sample of 200 grains prepared by Schönbein was procured by the U. S. Consul at Bremen and Major Mordecai made about eight small lots of not more than one pound each at Washington Arsenal. These were tested in November 1846 by means of a musket pendulum and a cannon pendulum. Major Mordecai's conclusion was that the propellent force of guncotton is about double that of an equal weight of gun powder. He also finds that there was no smoke from the discharge, very little residue was left in the bore, the report was not so loud as that of black powder, but in view of the intensity and quickness of its action, it could not be used with safety in existing fire arms.

Frederick Abel, chemist of the English War Department, discovered in 1865 a method of purifying the nitrated cotton by cutting the fiber into short lengths so that the residual acid in the hollow cotton could be washed out. He further tried to granulate the product by means of suitable solvents and patented such a process, but there is no record of a practical success.

In 1870 when Paris was besieged by the Germans, the difficulties of manufacture of black powder in a city under bombardment were so great that the French Government called on the scientist Berthelot to study and improvise explosives. This he continued to do after peace was declared and built up an organization which grew into the Central Powder Laboratory. Vieille, one of the engineers of this laboratory, made extensive researches on nitrocellulose and in 1886 developed a successful smokeless small arms powder which was termed *Poudre B* in which "B" stood for Boulanger. Whether this referred to General Boulanger, the then Minister of War or referred to the fact that the nitrocellulose was mixed with its solvent in the same type of machine in which bakers incorporate dough is debatable. Since Boulanger's loss of popularity and suicide, the latter explanation tends to gain ground.[1]

Other nations tried all means to learn the secret of this powder, which greatly increased the range, accuracy and rate of fire of small arms. In 1885 Alfred Nobel produced ballistite, a mixture of low nitration nitrocellulose with nitroglycerin in about equal parts. In this same year the British Government developed cordite, which was high nitration guncotton gelatinized with acetone, to which was added nitroglycerin and vaseline. In 1890 Mendeleef, following the work of Vieille on behalf of the Russian Navy, developed a completely gelatinized pure nitrovellulose powder which was being produced on a fairly large scale in 1893.

WHEN the Spanish War broke out in April 1898 the regular troops of the U. S. Army were armed with the Krag rifle and had fair stocks of a suitable smokeless powder, but the guns of the Navy were still using brown prismatic powder, of which there was no adequate supply, due to anticipated changes to smokeless. Hence a commercial firm was called on to make 5,000,000 lbs. of brown prismatic, of which 2,200,000 lbs. were actually made and delivered before August, when the war ended. The only ship in the U. S. Navy using smokeless powder in this war was the cruiser NEW ORLEANS built in England, having English guns and cordite. The Spanish War was the last in which black powder was used, for in addition to the guns of the Army and Navy, the volunteer troops were armed with the Springfield rifle, cal. .45, Model 1884, using this type of powder.

The construction of the U. S. Navy Powder Factory at Indian Head, Maryland, began in 1898 and several private corporations were in a position to meet the demands of this and other governments. In 1906 Congress made the appro-

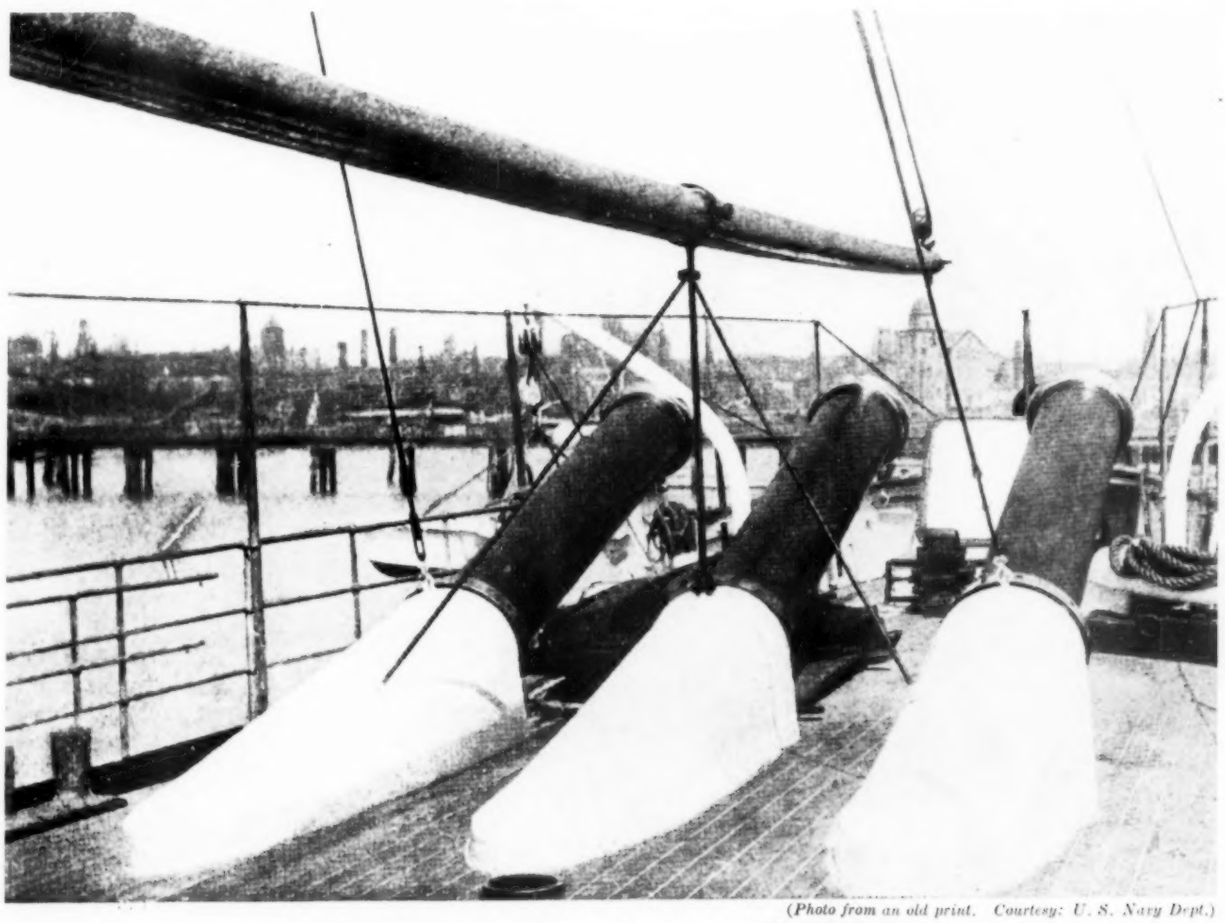
[1]Editor's Note: According to some commentators the "B" in *Poudre B* is an abbreviation of the French *blanche* (white) in contra-distinction to *Poudre Noire*, black powder; this nomenclature being derived from the white color of the nitrocellulose in the early stages of the manufacturing operations.

priation for a U. S. Army powder mill at Picatinny, New Jersey, and construction began in February 1907. Further development of smokeless powder was in the nature of improvement rather than any radical change.

Today France, Russia and the United States favor pure nitrocellulose powder for guns and small arms, while Great Britain, Italy and Japan use the double-base type containing nitroglycerin. It is a significant fact that there has never been a magazine explosion on an American naval vessel whereas there are records of four such disasters in the British Navy, four in the Japanese and two in the Italian. It may be noted that smokeless powder is far from being entirely smokeless and is not a powder, on the contrary, it is a tube, rod, disc or strip.

The development of commercial explosives containing nitroglycerin and/or nitrocellulose led to the idea of their use as a bursting charge for projectiles. Tests were made at Sandy Hook in 1883 with a blasting gelatin containing 4 per cent camphor which was successfully fired without damage to the gun, but when a gelatin of 92 per cent nitroglycerin and 8 per cent nitrocellulose was tried in 1884, a 3.2-inch gun was destroyed. A number of inventors tried to overcome the difficulty. In one plan glycerin and mixed acid were placed in the projectile to be mixed by the shock of discharge, the nitration taking place during the time of flight. While the plan worked, the amount of inert matter was so great that the projectile had no greater force than one loaded with black powder. The difficulty was finally overcome by using compressed air as the propelling force. There were a number of types, one of which, described in the *Scientific American* of April 5, 1884, was 4-inch bore and 40 feet long, the air entering through hollow trunnions. The projectile was a thin brass tube filled with dynamite, with an air pressure of 2,000 lbs. per sq. inch. This gun was expected to give a range of three miles. A battery of pneumatic dynamite guns was installed at Fort Winfield Scott, near San Francisco, in 1895. Other such batteries were installed at Sandy Hook in New York Harbor, Hilton Head, South Carolina, and Fisher's Island, New York.

The Navy built a ship, U. S. S. VESUVIUS, in which the discharge tubes were firmly fixed in the hull and could not be moved in azimuth or elevation. Pointing was accomplished by changing the course of the ship. Range was altered by throttling the air. Successful firings were made in April 1889. The VESUVIUS went into action against Morro Castle during the Spanish War and spoiled the appearance of the lawn. There was also a field gun of this type used by the "Rough Riders" in Cuba in 1898. In this case there was an auxiliary barrel in which the air was compressed by the discharge of a blank cartridge. The projectile with a bursting charge of dynamite, probably of the gelatin type, had a helical vane to steady its flight. *Scribner's Magazine* describes the destruction of a Spanish block house by a shell from this gun, at which time sixteen of the defenders were killed. Since this type of gun was easily outranged by the black powder guns of that time, and as seen above, smokeless powder had arrived, these unsuccessful contrivances fell into disuse and only exist today as starting devices in underwater torpedo tubes.



(Photo from an old print. Courtesy: U. S. Navy Dept.)

DYNAMITE GUNS ON THE FORWARD DECK OF THE U. S. S. VESUVIUS.

Proof Tests and Proof Marks

V: *Practices in the U. S. Military Service*

By Calvin Goddard*

SEARCH of available records discloses the fact that the first musket of Springfield manufacture to bear a proof mark was produced in 1799. This arm bore the letters "V.P.L." (see Plate IV, page 33, for this and other illustrations herein referred to). In 1802, a new stamping appeared, in the form of the letters "V.F." The following year (1803) these became "V.P.," while in 1806 we find a new design—an eagle's head in vertical line between a "P" and a "V." This last marking was continued with certain variations (as pictured in Plate IV) up to 1841.

During the period 1833-1842, the old regulation flint musket was being supplanted by the percussion type weapon. Many of the former were adapted for the new lock, with the result that numerous slight variations in proof marks occur in arms of this era—while many, indeed, lack them altogether. However, the "Eagle Head—P. V.," marking was continued without substantial change until 1862.

Between 1862 and 1869, the transition period between the percussion cap and the metallic cartridge, the same conditions prevailed. In 1869, an eagle head over crossed arrows, with the letters "U. S." beneath, appeared. This marking continued until 1878.

We lack definite information as to practices between 1878 and 1898, when the Krag-Jorgensen model of that date was adopted. (The information supplied one unfortunately disregards the Krag models of 1892 and 1896.) It is reasonable to assume, however, that new weapons of the old type produced during this period continued to bear the old marking.

With the advent of the 1898 model Krag, the proof mark became a letter "P" stamped on the barrel. In some cases it appears on the under side of the stock just rearward of the tang. This system of marking was continued upon the current model Springfield, and has remained in continuous use, with variations, to the present time.

Current practice is to place the letter "P" on the barrel after it has been proof-fired. Subsequent to assembly, a "P" in a closed circle is stamped twice upon the under side of the stock, one mark behind the other, to the rear of the tang. This indicates that tests for both proof and function have been conducted. In addition, a punch mark is placed on the receiver just below the serial number, and on the bolt handle close to the body of the bolt, as well.

The proof of a barrel consists in firing two cartridges giving a pressure of 68,000 ± 2,000 lbs., followed by five rounds of service ammunition developing normal pressures.

Automatic pistols and revolvers chambered for the .45 automatic pistol cartridge are tested with loads developing 20,000 lbs. pressure. On acceptance, they are stamped with the small letter "P." This is placed—in the case of pistols—on the barrel lug; in the case of revolvers—on the frame.

(While the above data were compiled from studies of arms produced at Springfield, it may be noted that those fashioned at Rock Island and Harper's Ferry conform in markings to those above described.)

ADDENDUM: In paragraph one of the second instalment of this series of articles (ARMY ORDNANCE, January-February, 1934, page 225), the statement is made that the Belgian Proof House at Liége was established in 1888. This should be amended to read "legally recognized by the Belgian Chamber of Deputies in 1888." As a matter of fact, its inception dates to 1672. On May tenth, of that year, the Prince of the Church then reigning in those parts, published an ordinance embodying two principal provisions, viz.: 1. The imposition upon all vendors of arms of the obligation to submit them to proof tests, and, 2. An absolute prohibition upon all traffic in unproven weapons.

This ordinance was the result of complaints addressed to the Burgomaster of Liége by many citizens of that city, who affirmed that numerous seriously defective pieces were being sold by unscrupulous dealers. It may be interesting to compare its text, printed below, with that of the British Charter of 1637 (extracted in the 1st instalment of this series of articles in ARMY ORDNANCE, November-December, 1933, page 140, paragraph 2.)

"Ordinance: Governing the Proof of Arms (10th May, 1672). His Most Serene Highness and his Privy Council, being informed by complaints both from his subjects and his neighbors, that certain defects exist in arms fabricated in this his City, his said Highness, desiring both to advance the welfare of (his) commerce, and to provide adequate safeguard to purchasers, has found it suitable to establish the following regulation, to-wit:

That the Magistrate of his said City shall designate a public place whereat the proving of arms shall be carried out, to which (place) all merchandisers (of arms) shall be held and obliged to bring all musket barrels or other (barrels) of whatever sort, both those imported from without and those forged in the said City, together with the powder and lead necessary to their proof.

And being once well and soundly proven, these (weapons) shall be stamped with the arms of His City, for which (service) the dealers shall pay to the profit of His City, five sols (equivalent to five cents) for each musket, gun, or musketoon-barrel, and ten liards (1¼ cents) for each pistol barrel.

That no arm may be sold or accepted in this City and its suburbs which shall not have passed this proof and received the City's mark—under penalty of one florin (forty cents) fine, in addition to the confiscation of each barrel (involved).

His said Highness enjoins upon one and all (of his subjects) that they conform to this decree, and (especially upon) those whose duty it may be to undertake the enforcement of the present edict.

Done in the Council of His said Highness, 10th May, 1672."

The ordinance of 1672 was followed by a set of regulations,

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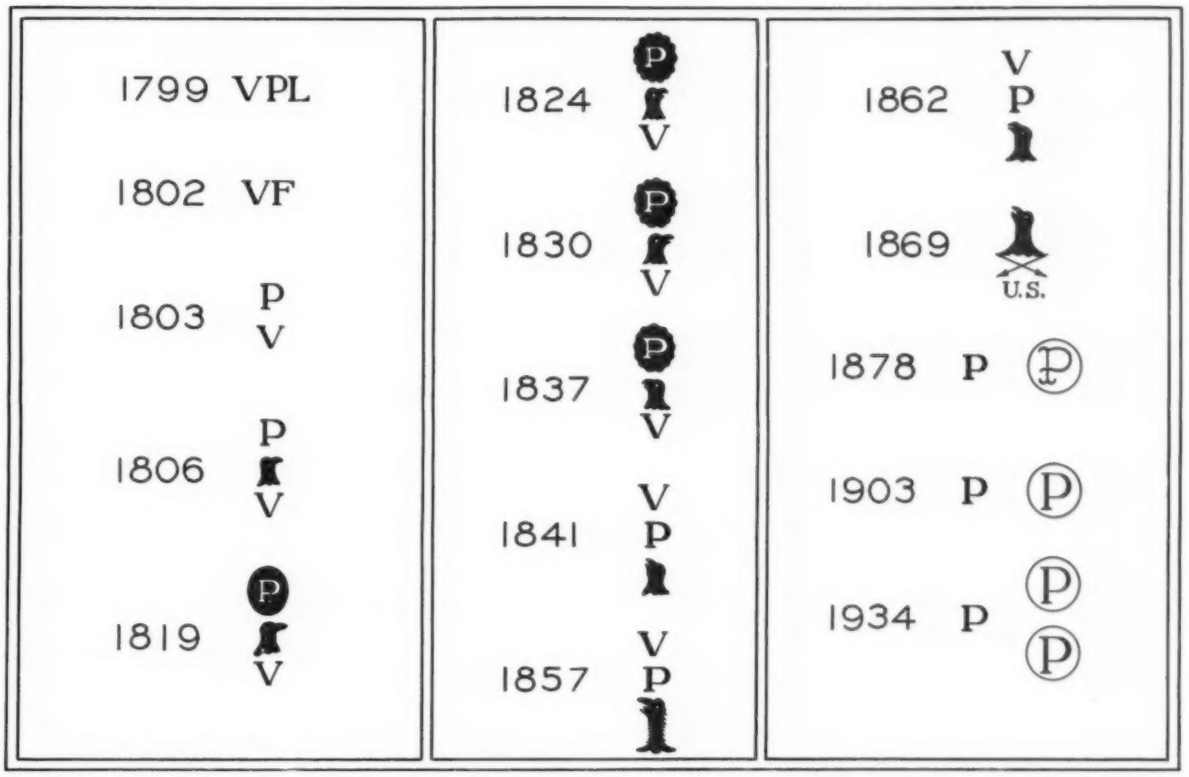

PROOF MARKS USED AT UNITED STATES GOVERNMENT ARMORIES, SPRINGFIELD, HARPERS FERRY, ROCK ISLAND, 1799 TO 1934.

published August 29th of the same year, outlining the provisions under which it should operate. One of these established, as punishment for counterfeiting the mark of the City, or employing any other fictitious mark (in addition to "the pain of the Law") deprivation of the rights of citizenship, plus a fine of one hundred golden florins—and confiscation of all arms falsely stamped.

The ordinance and regulations of 1672 seem to have obtained until 1810, when Napoleon I of France, Belgium then being under French domination, issued a new decree, much more comprehensive than its predecessor. One provision established a fine of fifty to one hundred francs for vendors of barrels of calibers not conforming with the marks stamped upon them at the time of proving.

Followed the regulation of 1818 which, among other things, instructs the local police (of Liége) to make periodic visits to the shops of those engaged in the vending of arms to assure themselves that no barrels not properly proved are going into commerce.

Subsequent to the assumption of indepndent sovereignty by Belgium, four Royal Decrees issued in fairly rapid succession (1836; 1846; 1849; and 1853), enlarging upon certain features in the administration of Proof Regulations. In article 40 of the Royal Edict of June 16, 1843, we find illustrated three proof marks which yet remain current, namely, the "E.L." intertwined (see ARMY ORDNANCE, January-February, 1934, page 225, last line), the "Tower" (see line eight, column two, same page), and the mark of acceptance (the letters "E.L.G." in an oval surmounting a star (see line six, same column and page). With respect to these particular stampings, then, we can state definitely that they have been current for close to a hundred years.

As previously indicated, the law of (May 24) 1888 gave the Belgian Proof System a legal status which it had not previously enjoyed, despite the fact that the provisions of the several decrees and ordinances establishing it and defining its functions had long been carefully observed. In which connection, it may not be amiss here to quote from a report of the Central Committee of the Chamber of Deputies which was then considering the enactment of this piece of legislation, in which we learn that:

"Although regulated by the State, the Proof House does not belong to it; it is an establishment founded and maintained by arms makers.

"It enjoys no civil identity. As a result, it occupies an uncertain position as a public utility secularly recognized. It cannot possess the personal property required for its operation, nor be party to a suit at law.

"The object of a law (the one then under consideration) is principally to put an end to this situation by giving the Proof House a judicial identity—it tends also to define more clearly the police powers of the agents of said Proof House, to render more concise the definition of infractions (of proof regulations) and improve the character of (their) enforcement."

The activities of the Liége Proof House were subsequently further regulated by the Royal Decrees of March 6, 1889, Jan. 17, 1892, July 11, 1893, and Jan. 30, 1897. Later, the law of 1888 was modified by one enacted Aug. 10, 1923, this in turn being supplemented by Royal Decrees of (June 30), 1924, (May 24), 1928, (Nov. 12), 1929, and (Feb. 26), 1930.

Thus we see that the Belgians—not to mention others among our European brethren—take their proofs seriously.

Erratum: In the first instalment of this series (ARMY ORDNANCE, November-December, 1933, page 148, line 11), "28 inches" (in parenthesis) should read "2.56 inches." (*This concludes the series on "Proof Tests and Proof Marks."*)

Erosion in Machine Gun Barrels

A Review of Existing Data and an Exposition of Some Theories

By J. C. Gray*

MACHINE gun barrels offer an interesting field for investigation by the metallurgist, particularly in respect to the changes in crystalline structure of the bore surface which has been subjected to the conditions of extended firing. A brief review of existing data, together with an exposition of some theories on the mechanics of erosion is the purpose of this article.

Machine-gun barrel steel should have the following properties: strength, machineability, resistance to abrasion, notch toughness, small coefficient of thermal expansion, great thermal conductivity, high melting point, stability of crystalline structure, low cost. Typical analyses of steel selected as likely to have the characteristics just described will be found in the table of alloy steels (Table I, page 35).

The results of erosion tests which have been made from time to time indicate that with present methods of manufacture and heat treatment, machine-gun barrel life is about the same regardless of the type of alloy steel used. An investigation of the results of firing machine-gun barrels in which were included barrels of upwards of twenty different alloy steels is the basis for the statement concerning the effect of the type of steel used. In heat treating the alloy steels shown in the table the object was to obtain a homogeneous sorbitic structure. Minimum physical characteristics required were: Elastic limit—75,000 pounds/sq.in.; tensile strength—110,000 pounds/sq.in.; reduction of area—45 per cent; elongation—20 per cent. A careful determination of quenching temperatures was made on each sample and the results applied to the barrel blank. Other tests made from time to time also confirm in general the statement made previously.

Experiments with various kinds of powder indicate that the character of the powder has a material effect on the rate at which erosion takes place. The indications are quite definite that a nitrocellulose powder produces less erosion than one of the double base type containing nitroglycerin. Some nitroglycerine powders appear to be almost equal to the single base type in respect to their effect on erosion but, in general, experience has shown that somewhat increased erosion may be expected when nitroglycerin propellants are used. In this study the matter of the powder factor will not be further considered because the mechanics of erosion are the same. Any means which will produce increased accuracy life will do so regardless of the powder factor. However, the powder factor will affect the overall result.

APPARENTLY erosion follows a course which includes, first, a hardening of the skin of the bore, followed by a cracking, longitudinally and transversely. These cracks are enlarged by the effect of gas at high velocity temperature and pressure, and quite probably by bombardment of extremely hot particles of burning powder and primer. Some removal of metal is considered to be caused by abrasion of the bullet. However, it is evident from the experiments which have already been made that the abrasive action of the standard U. S. Army caliber .30 bullet is not excessive. This statement is justified by the fact that machine gun barrels which are quite useless because of erosion at the bullet seat are only slightly worn at the muzzle.

The temperature of the combustion products of modern powders is in the order of 3200° to 3500° F. It is apparent that when exposed to temperatures such as the above the inner skin of the gun barrel just in front of the chamber reaches the melting point. In effect this results in "gas washing" the bore surface and rapid removal of metal.

There are several theories in regard to the causes of hardening. One is the cementation theory which claims that the combustion products of the powder heat and carburize the inner skin of the bore. After each shot, due to the proximity of a mass of cold steel, rapid cooling takes place, which is sufficient to harden the surface. Macrographs of cross sections of machine gun barrels which have been subjected to erosion tests show a thin layer of structure that is different from the remainder of the bore. In this study it is assumed that this thin layer may be martensite, as it shows many of the characteristics of martensite, or it may be austenite or even troosite.

Another theory is that the inner skin of the bore is hardened by the mechanical work of engraving the rifling on the bullet. However, it seems reasonable to suppose that the effect of mechanical work in hardening is negligible because of the effect of the hot powder gases.

There are several possible explanations for the formation of the network of cracks just in front of the chamber, which is always found in machine gun barrels which have been worn out by firing. In a bore having a hard brittle lining the next explosion exerts stress on the hard thin skin and cracks it, or possibly cracks are formed by expansion and contraction due to overall temperature effects which cause the entire barrel to expand and contract. Micrographs show the deepest cracks to be located at the corners of the rifling. Such corners are easy starting places for a crack. Also, from the thermal expansion viewpoint, during the firing of each shot a complete cycle of heating and cooling occurs. Strains are set up in the inner skin because it cannot expand proportionately to the increase in temperature. In passing through the critical range of temperature in both heating and cooling, there is a reversal in the change of volume. The cold outside part of the barrel opposes this action, thus setting up strains which crack the inner skin.

The matter which follows relates to microscopic examinations made of several steels as affected by erosion. ("Test of Metals." 1913; page 137). "Each steel has developed a hardened inner layer, partially due to the flow of metal alone but more particularly to the change in the form of carbon. There was also a development of heat cracks, the greatest development taking place where there has been the greatest change in the form of the carbon.

"The change of structure . . . in the nickel steel is shown at

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the inner edge of the nickel steel tube. Three distinct structures are seen. On the firing side into which a crack has developed the structure is that characteristic of a completely hardened steel and is known as martensite. At higher magnifications this appears as a mass of needle-like crystals interpenetrating each other at an angle of about sixty degrees. In this area, which is about .015-inch in width, all of the carbon is in the 'hardening' carbon form. Beyond the martensite is a uniform layer of troosite of approximately the same width. This layer is less hard but somewhat harder than the original steel. In it the carbon has been partially transformed from the 'hardening' into the carbide state. This is an intermediate transition stage between martensite and sorbite. The third structure is that of sorbite similar to the original steel but not showing the granulation of the original. The carbon has still further transformed into carbide carbon and the structure should have been that of pearlite."

The foregoing relates to examination of steel exposed to erosion test in cannon. The report states: "Similar changes have taken place in the small arms steel, only to a smaller extent, the respective widths of the martensite and troosite areas being respectively .004-inch and .006-inch." Further quoted from the same source: "The cause of the changes in structure and the corresponding changes of carbon form is due to the heating of the metal above the critical temperature. In order to form martensite the steel must be heated to above the critical temperature and rapidly cooled. With more slow cooling troosite results."

A VERY important influencing factor is the position of the critical transformation. Among the elements which raise the critical temperature is chromium. Nickel and manganese both have a tendency to lower this point. Consequently in a nickel steel the chances of producing martensite at a given temperature are greater than in a steel where no nickel is found or where chromium occurs.

In the small arms steels there is the counteracting influence of chromium and nickel, the ratio of nickel to chromium being about the same and the nickel exerting a greater influence than the chromium. There is the added influence of a larger amount of manganese in the small arms steel. It would therefore be expected that the small arms steel would more readily show martensite.

Experiments have been made with machine gun barrels nitrided on both the bore surface and on the outer circumference. The nitriding process produces a very hard "nitride" case. Sections of barrels which were given a nitride case and subjected to erosion test are shown in *Transactions of the American Society for Steel Treating*, Vol. XVI No. 5 (October 1929). These do not differ physically from those already described, showing the typical network of cracks.

In this paper, H. H. Lester, Research Physicist, Watertown Arsenal, states: "There occurs in the bore of a gun after firing a glass hard surface skin usually called the 'white layer.' The nature of this layer has been the object of many investigations and there is extensive experimental data with regard to it." This layer seems to result from the effect of hot powder gases in contact with the bore surface at high pressures. Evidence from the metallographic and X-ray examination indicates that this layer is probably the result of nitrification.

The layers studied (in the paper just quoted) appeared to be largely austenite, although in the machine gun barrels there were also some indications of martensite. If it is admitted that the structure is austenite, then the matter of grain growth is of importance, because austenite, under satisfactory conditions of carbon diffusion, and at high temperature, will grow big grains rapidly. Experiments with a 40 per cent nickel steel show the austenite structure plainly. Micrographs were characteristic of austenite and an examination of the edge of the bore indicated that the hot gases penetrated the large austenite grain boundaries and produced rapid erosion.

The importance of carbon content in the production of hardening is obvious when it is remembered that water quenching does not greatly harden steel containing less than 0.15 per cent carbon, and that as the carbon increases, the obtainable hardness also steadily increases. Considering that hardness is controlled by crystalline structure, it is evident that the desired characteristics of *stability of crystalline* structure stated in the paragraph on desired characteristics of barrel steel is to a considerable extent a function of the percentage of carbon in the metal.

Powder gases carry not only carbon but nitrogen and the metal surface of the gun tube, if heated to the austenitic state, would absorb both carbon and nitrogen. It is quite possible that both elements contribute to the hardness. In a brief study such as this, and in consideration that extensive evidence from experiments is lacking, it is not possible to go into such matters as the effect of slip lines in nitrided layers. Again, even pure iron when passing through the range of heating and cooling such as would occur in a machine gun barrel goes through several stages of crystalline structure. At high temperatures a body center cubic is found which changes to a face center and again to a body center cubic form as cooling progresses. During these changes, contraction, expansion and then slight expansion occur and these themselves may be the cause of the initial cracking of the barrel's bore surface.

TABLE I: TABLE OF ALLOY STEEL

C	Mn	P	S	Si	V		
.45	1.30	.06	.06	.20			
.45	.60	.06	.06	.20			
.60	.95	.04	.03	.40			
.45	.60	.025	.03	.20			
.30	other elements as low as possible						
.45	.60	.10	.06	.20			
.45	.60	.025	.03	.20	.20		
C	Mn	P	S	Si	Cr	V	
.30	.50	.025	.03	.15	.50	.10	
.35	.10	.025	.03	.10	1.10	.15	
.35	.60	.025	.03	.10	1.10	.15	
C	Mn	P	S	Si	Cr	V	Ni
.15	.55	.03	.03	.15	1.50	.15	3.25
.20	.10	.025	.03	.10	3.00	.30	4.00
C	Mn	P	S	Si	Cr	V	Cu
.15	1.20	.04	.04	.15	.75	.25	2.50
.15	.40	.04	.04	.15	1.25	.25	2.00
C	Mn	P	S	Si	Cr	V	W
.60	.85	.02	.02	.10			1.25
.45	.50	.025	.03	.15			3 to 5
C	Mn	P	S	Si	Cr		
.20	.25	.04	.02	.62	.4		
C	Mn	P	S	Si	Cr	Al	
.45	1.30	.06	.06	.20		2.00	
C	Mn	P	S	Si	U		
		.04	.04		2.00		
C	Mn	P	S	Si	Cr	V	Mo
.10	.20	.04	.04	1.20	1.50	.20	
.10	1.25	.04	.04	1.20	1.00	.20	
.10	.30	.04	.04	.15	1.0	.25	.75
C	Mn	P	S	Si	Ni		
.45	1.10	.06	.06	.25	.25		
.45	1.10	.06	.06	.25	1.50		
.35	.65	.04	.03	.15	3.50		
.30	1.00	.03	.03	1.25	3.50		

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Month by Month

ALL members of the Association will join in greetings to Brig. Gen. Herman W. Schull, Assistant to the Chief of Ordnance, who assumed his new duties June 3, 1934. As was announced in the last issue of ARMY ORDNANCE, we dedicate this number to him in tribute to his long and valued military service. He has succeeded to the office of Chief of Manufacture of the Ordnance Department of the Army, a post of distinction already made memorable by the service of his predecessors. Brig. Gen. John H. Rice served in this post-war capacity from 1919 to 1921, as did Brig. Gen. William S. Peirce from 1921 to 1923. In 1923 Brig. Gen. Colden L'H Ruggles assumed the duties upon the death of General Peirce. When General Ruggles retired from active service the present Chief of Ordnance, Maj. Gen. William H. Tschappat, was appointed to it and when General Tschappat was promoted Chief of Ordnance in June of this year General Schull became the fifth occupant of this post-war creation.

GENERAL SCHULL

General Schull entered the United States Military Academy from South Dakota, was graduated a member of the class of 1899 and was commissioned a second lieutenant of Artillery. His first duty was with his battery at Havana, Cuba, where he served until July, 1900. In 1901 he was promoted to a first lieutenancy in the Artillery Corps while with the Recruiting Service at Reading, Pa. In June, 1902, he was detailed as a first lieutenant of the Ordnance Department and again returned to Cuba. He served at the Sandy Hook Proving Ground for one year to June, 1903, when he became inspector of ordnance matériel at Frankford Arsenal where he remained until 1906. He was promoted a captain of the Ordnance Department in September, 1904. Following his service at Frankford he returned to the Coast Artillery and later was assigned as principal assistant in the Office of the Chief of Ordnance. In 1909 General Schull, then a captain, served at Watertown Arsenal in charge of shop operations. The following year he was promoted to major. During the next three years he served in the Philippines, returning to Frankford Arsenal in 1913 where he was in charge of the manufacture of artillery ammunition.

At Springfield Armory from September, 1914, to August, 1915, he was in charge of shop operations, and was on duty at Benicia Arsenal, Calif., from November, 1915 to September, 1917. Meantime he was promoted to lieutenant colonel, Ordnance Department. He was on duty in the Gun Division, Office of the Chief of Ordnance, to January, 1918. After several months at the Aberdeen Proving Ground he returned to Washington in March of that year where he served as assistant chief of the Inspection Division and with the Ordnance Claims Board until September, 1919, when he became commanding officer of the Proving Ground. In 1922 Colonel Schull was a student at the Army War College from which he was graduated, June, 1923. Then followed a tour of one year as Chief of the Technical Staff of the Ordnance Department, and in 1924 he became commanding officer of the Springfield Armory which office he held for five years. In September, 1929, he succeeded General Bricker as commanding officer of the Watervliet Arsenal. On March 4, 1932, he succeeded Col. D. M. King as commanding officer of the Rock Island Arsenal.

For his war service General Schull was awarded the Distinguished Service Medal with the following citation: "As assistant chief and acting chief of the inspection division, ordnance department, his broadminded policy, zeal, and technical ability contributed in a conspicuous way to the success of the ordnance department in the procurement of munitions in the United States and Canada during the World War."

This long and diversified record of ordnance responsibility indicates the experience and ability which General Schull brings to his present assignment. As commanding officer of three of the Army's largest manufacturing arsenals and as commanding officer of Aberdeen he has come to know the problems of industrial preparedness in an especial way. So also the civilian component which has sponsored industrial preparedness has come to know him and to admire him for his breadth of vision, technical understanding and kindly character. To him upon his entrance to his latest and most important assignment we bespeak the congratulations of the Army Ordnance Association and pledge to him the interest and coöperation which the organization has been privileged to extend to his distinguished predecessors.

AFTER listening to and reading much of the interminable nonsense of the day about war and war costs, the believer in national preparedness as a guarantee of peace can well begin to wonder whether he alone is insane amid a world of sanity. So much crack-brain philosophy meets him at every turn that he is forced almost to the conclusion that experience is no longer the best teacher. No pacifist, no matter how sober, seems to give a snap of his fingers for experience. And yet theory without factual historical basis does not count for much except, it seems, on the question of the right road to peace. It is a road on which no nonsense should be permitted.

A MILLION DOLLARS AN HOUR

Hence it may be opportune to recall some of the facts upon which we of the Army Ordnance Association and others like us base our stand for industrial preparedness as a guarantee of peace. The facts of the case do not interest the loud-mouthed

shallow-minded critics but they are facts nevertheless. It is well known that the American people as a people are not war minded; they have not been in the past and, we hope, never will be. As a people whose traditional policy is peace, they have always indulged their peaceful attitude even to the extent of terrific cost in lives and money when war comes. No historian can say that the United States became involved in a war that it was ready for. In all probability if war is ever to be our lot again, it will never be said that we were ready. We have never been a militaristic nation, we have never put our trust in huge standing armies or in great armaments and as long as we are what we are we will not do so.

Analysts of national defense agree that the three components of successful war-making when a country is attacked are men, money and munitions. And with us the last of these in the light of experience and of our present position is the most difficult to obtain. On this point we would like to recall a few facts from our World War record. From our unreadiness to plan and to produce armament in time of emergency grew the determination to be prepared industrially if another war should come.

The cost in men to the United States was 50,300 battle deaths; the losses were not more severe because our armies were in heavy fighting for only 200 days. Yet 35,560 were killed in action, 14,720 died of wounds. The total wounded were 205,690. So much for the frightful human toll.

The World War cost the United States more than a million dollars an hour for the period of twenty-five months from April, 1917, through April, 1919. There was paid out of the Treasury during the period, $23,500,000,000, of which about a billion and a half represented normal expenses of peace time. In addition we were the bounteous lender of nearly half a million dollars an hour to the Allies. There was actually paid to various governments the sum of $8,850,000,000. There was actually drawn from the Treasury of the United States $14,244,061,000 for Army costs which was just short of two-thirds of the entire expenditure. Of this, $4,087,347,000 or 28.7 per cent was expended on ordnance—or military armament—or munitions! This represents the cost in dollars.

The total cost in munitions is equally impressive. We shipped 1,775,000 rifles, 29,000 light machine guns, 27,000 heavy machine guns and 1,500,000,000 rounds of rifle and machine-gun ammunition. Before the end of the war American production of small arms ammunition amounted to approximately 3,500,000,000 rounds. When war was declared we had on hand 900 pieces of field artillery, sufficient light artillery to equip an army of 500,000 men. In spite of all handicaps through lack of familiarity with production, we actually produced 1,642 complete units before the Armistice was signed. But the artillery ammunition problem was staggering. By the end of 1918 the number of complete rounds produced in American plants was in excess of 20,000,000. The production of smokeless powder was 632,000,000 pounds; the production of high explosives 43,000,888 pounds. Yet for all this, only 477 pieces of artillery of American manufacture arrived in France and 130 American-made pieces were used in battle. Only 8,400 rounds of American-made ammunition were expended in battle. It took us that long to get going. Our "munitions makers" had to be taught from the ground up!

Here then is the basis of the belief in and reliance upon industrial preparedness in the United States. Industrial preparedness means simply that our peace-time industry in peace time knows what its job is in the event of war and knows how to do that job with efficiency and promptness. It is not predicated upon a standing army larger than our geographical defense needs nor upon huge supplies of armament in peace and, least of all, it is not predicated upon a desire on the part of any single individual for war or for inordinate profit. It is based only upon planning and knowledge of the job whenever it must be done. It aims only to reduce the cost in men, money and munitions. Critics of American munitions might bear these facts in mind and be fair enough to give them recognition. They present a factual case which is on a far higher plane and which is of far deeper and sounder significance than to warrant the thrust of shallow publicity seekers who seem intent by fair means or foul to undermine the lesson of experience. Against the factual record the present attack is nonsense; quite often it is not honest nonsense at that.

National Defense and the Churches

SEVERAL significant pronouncements have come recently from pulpits of our churches which sound a clarion note of sane national defense doctrine. We call these significant because they seem to us accentuated by their source: they come from leaders of their respective groups who speak with some measure of authority. We assume these statements can be taken as representative of the general attitude and prevailing opinion of the groups with whom these spokesmen are identified. Moreover these pronouncements come at a time when many other churchmen of various leanings are giving vent to all sorts of outlandish opinion on the cause and cure of war. Hence we feel that these sane statements are worthy of particular note.

The occasion for these addresses was incident to the welcome extended to the United States Fleet while visiting New York Harbor last month. Rt. Rev. William T. Manning, addressing members of the Fleet at services held in the Cathedral of St. John the Divine, emphasized his certainty that no one was more earnestly opposed to war than the officers and men of the Navy and of the Army. He further asserted that "we are all opposed to war," but added that the extreme pacifism of a "considerable number of ministers" was to be deplored because it repelled strong men from the church and because there were situations in which the use of force was more than justified. "There are cases," he said, "where the man who would not use all the force at his command would be a craven coward, unworthy to be called a man. Extreme pacifism is not Christian—the Christian religion is never out of accord with the facts of life as this position is. The Christian must not love peace or material welfare or bodily safety or life itself more than he loves righteousness."

Cardinal Hayes, addressing members of the Fleet at services held at St. Patrick's Cathedral, took as his text the Biblical quotation "When a strong man armed keepeth his court those things are in peace which he possesseth." He said in part, "Unpreparedness on the part of our defense arms of service, on sea and on land, at the critical period of these fermenting, fomenting and seething times amid openly avowed hatreds abroad and disloyalties at home would be supreme folly. Peace throughout the world is the heart's desire of the American people, but until Europe and Asia change their war-like aspect, adequate defense is absolutely necessary here at home. The armada, now at anchor in our

favorite waters, terrifying though it be in appearance and latent power, is one of the best guarantees of peace, good will and security."

Speaking at Marble Collegiate Reformed Church, Rev. Norman Vincent Peale said, "We might as well be realists. We live in an imperfect world in which nationalism, with all its concomitants of hate, selfishness and power, has had recently a profound resurgence. Hatreds born of the last war have been smoldering for a decade. The notable peace movements of the post-war years have done much to create an anti-war psychology, but there is grave doubt if they are strong enough yet to prevent future hostilities."

Here we have expressions of attitudes from prominent spokesmen whose desire for peace is representative of the American people as a whole. Happily they see in proper measures of national defense the safeguards for peace which experience proves to be necessary. Not only that, their realism connotes a viewpoint which will appeal to thinking men and women who will be led to the ministrations of the churches the more surely when the morality of all problems of life as it is, is preached. There is a growing body of opinion in this country and abroad which sees the error of attacking war through its effects rather than its causes. The exposition of this error, as we have indicated before in these columns, has as one of its leading American spokesman Hoffman Nickerson in his book, "Can We Limit War." The great confusion now existing between cause and effect is contributing in no small measure a harmful attitude toward national defense itself. When moral leaders like those we have quoted above direct opinion in realist channels they are doing a distinct service to the nation. It is unfortunate that many others of various denominations are not gifted with the same discerning logic and that they continue with unabated zeal to attack national defense as a cause of war when in reality it aims to and does guarantee peace. Excessive armaments, which happily we do not have and never have had in the United States, are the effects of fear or injustice or both. Only when the causes are remedied will the effects be lessened. We share the Nickersonian belief, followers of which are increasing in numbers, that only when there is a common moral unity throughout the world will war be limited; in the absence of such unity when "the strong man armed keepeth his court those things are in peace which he possesseth."

THE very timely article, "Shells, Shrapnel and Statecraft," by Col. G. F. B. Turner in this issue of ARMY ORDNANCE, is worthy, we believe, of special emphasis. Not that we propose to become involved in a subject which military men of World War experience will debate until their long line becomes extinct, nor that we intend here to take sides on the general merits of shell versus shrapnel in modern warfare. That part of the question relates particularly to the field of tactics wherein only the tactician is worthy to be heard. The observer may, however, with propriety express himself on the relation of shell or shrapnel or both to statecraft. In such a discussion as Colonel Turner presents the relative merits of these forms of artillery ammunition are merged so that they occupy a unified front on the one hand with statecraft as the opposing force. Neither are we concerned with personalities no matter how dynamic or how highly political they may be.

SHELL VS. SHRAPNEL

The object lesson of the English situation during the World War is presented in the perfectly obvious condition which modern war creates. It might be set down as axiomatic, we believe, that the soldier cannot take entire command of the nation in arms and similarly that the statesmen cannot take entire command of the men in arms. Both have a distinct sphere wherein the nicety of balance between contacting or overlapping functions may decide whether there is success or failure in the ultimate effort. Of all the elements concerned it must be apparent in such a situation that the professional soldier whether he be a technician or a tactician is, after all, a professional man. He knows by training and experience what the inherent difficulties of operation are. Usually he tries to foresee them and to overcome in advance such obstacles as may hinder their performance. He is not sluggish or blind or dumb no matter how constant may be the charge that he is grooved in his opinion and set in his ways. When he is confronted with the problem which faced the British Army in 1914 he cannot be supplanted or brushed aside by the statesman no matter how energetic the latter may be, for the sole reason that the military man does know the problem thoroughly while the statesman may not. Thus the former Prime Minister who has not minced his words in criticism of the War Office flounders on what appears to be the baldest sort of problem—that of the artillery fuze.

Here in this country we had such problems, of course, but it will be to the lasting edification of our people that the civilians of industry who came to the rescue of the Army program had no preconceived ideas or erroneous leanings. Their job was to get from the machines and plants of industry what the military forces required. And they got it. The result has been a working team wherein the two elements have mutual respect and admiration for each other, where helpfulness is the keynote and where results, if the problem materializes again, are more quickly and more economically assured. At least we can say with confidence that our own problem of the lowly booster for artillery ammunition production, or anything like it, did not create the harmful disturbance which fuzes for artillery ammunition wrought in Great Britain. We were more fortunate in statesmen at those times. Or, as no disparagement is intended, better say that our industrialists who were our war statesmen were like the majority of British statesmen and unlike the one whose carping criticism Colonel Turner refutes so completely.

For example we find such instances as these in that monumental record "America's Munitions" by our own World War Director of Munitions: "When we entered the war the quantity of field artillery ammunition on hand was considerably less than a single month's supply, basing our rate of expenditure on the estimated rate for November 1918. There were no facilities of any degree of magnitude available to take care of our projected program for filling the high explosive shell necessary for use by our overseas forces. Consequently it became necessary at once to develop the resources of the country for the production of metallic parts, such as the shell proper, the fuze, boosters and adapters, as well as to design and build entirely new plants and to train completely new forces for the loading of the shell with the high explosives. . . . Unexpectedly the manufacture of boosters and adapters proved to be more difficult than it appeared to be at the start, and the shortage of these devices was a limiting factor in the American production of shell. . . . How successful we were in getting into quantity production on ammunition after the numerous and large ob-

stacles in the early months of the war can be indicated best by the fact that of the 11,616,156 high-explosive shell for 75-mm. guns machined up to November 1, no less than 2,893,367 passed inspection in October; while of the 7,345,366 adapters and boosters for 75-mm. guns that had been machined up to the 1st of November, 2,758,397 passed inspection in October." Our good fortune was in the spirit and ability of our leadership.

PASSAGE of the resolution by the Congress and its approval by the President to prohibit sales of war supplies to Paraguay and Bolivia in an effort to stop the fighting between these countries in the Grand Chaco is an interesting development both as to its diplomacy and its ultimate effect on peace between those countries. This action of forbidding shipments of supplies to the belligerants was based upon the assumed coöperative effort of all other so-called arms-producing nations. As yet action has by no means been general so that the desired effect at this writing has not been achieved. The United States has stepped out of the picture to the detriment of its own foreign trade while others have not only stayed in the picture but are in it more definitely.

PEACE BY EMBARGO

It is not the province of this Journal to be especially concerned with the maneuverings of international diplomacy as such. Yet we cannot help feeling as the *Chicago Tribune* does: "This act ends the application of a hitherto unbroken principle in American international relations—the doctrine of the right to buy and sell material to be used in war.

"It may be that the United States is better able now than ever before to produce what it needs in war, but many essential reservations must be made to any such conclusion. One important item would be rubber. There are many others. Arms and munitions make a vague phrase. Cotton is a harmless article in ordinary commerce, an ingredient of explosives in the making of munitions. A proposal to put an embargo on war supplies was heatedly debated in the early days of the World War, and, mixed as were the motives for not stopping this trade, there was back of them the historic argument of the United States that it retains the right to buy when in need where it can and sustains that principle by keeping its own markets open to others in need.

"Much has been said to fasten infamy upon this trade, and in turn upon the principle, but it has been a matter of extreme importance to the United States. At times in its history the ability of the American government to buy what its troops needed was one of the guaranties that it would not come out second best in the struggle in which it was engaged. That was true of the Civil War.

"The war in the Chaco has been regarded as highly offensive and abhorrent to humanity. It appears as a terrible, savage jungle fight in which conscript Indians and ambitious and excited nationalists are perpetrating outrages upon human flesh for no good reason at all. It has continued relentlessly and hopelessly. The world has turned squeamish on the subject. Humanitarians in and out of the League of Nations have cried stop, but to no avail. The imagination is disturbed by the picture of this warfare and the sentiment against it is creditable to the people disturbed. Certainly the same thing could have been said and was said of the tremendous slaughter in Europe. It seemed without good purpose and subsequent consequences have never proved pure statesmanship in the men who made either the war or the peace. Going back further, it will be recalled that powerful European countries thought the fight between the North and the South ought to be stopped, preferably at the cost of American unity. One fellow's judgment upon another fellow's war is not inevitably sound, well informed or even disinterested.

"The departure from the American traditional principle may be regarded as something demanded by humanity and it may also be considered for the possible embarrassments it may contain at a future time when the nation could regret that it had established a precedent applicable in its own case and against its best interests. Sentiments superficially attractive are not always fundamentally sound. The war now in question seems to be an unnecessary misery. If it could be stopped through the good offices of other countries, relief to the warring peoples would be great. It is also other people's business. The Chaco may be worthless, but that statement from a distance might have been made regarding much American territory brought within the jurisdiction of the United States by struggles with other peoples. The arms embargo may rebound upon the United States at some future time."

There is just one aspect of the matter which should be emphasized in these pages. The *Tribune* refers to it when it says "arms and munitions make a vague phrase." When the Foreign Affairs Committee of the House of Representatives presented its report in favor of the resolution it appended to that report a table showing that more than $750,000 worth of "arms and ammunition" had been exported from this country to Bolivia and Paraguay during 1933 and the first three months of 1934. The table follows:

AMOUNT OF EXPORTS, 1933

Type of Munitions	*Bolivia*	*Paraguay*
Revolvers and pistols	$ 541	
Mach. and heavy ordnance guns and carriages	357	$ 36,400
Shot shells	426	
Metallic cartridges	67,123	
Other ammunition, including fireworks	5,977	
Smokeless powder	316	
Dynamite	33,002	
Other explosives	40,125	
Aircraft	133,000	
Engines for aircraft	57,688	
Aircraft parts and accessories, except tires	64,054	11
Parachutes and parts	6,098	2,100
	$408,707	$ 38,511

FIRST THREE MONTHS OF 1934

Shotguns	$ 676	
Revolvers and pistols		$ 63
Mach. and heavy ordnance guns and carriages	69,945	55,500
Metallic cartridges	114,762	
Other ammunition, including fireworks	1,259	4,655
Explosives	68	
Aircraft	15,990	
Aircraft engines	28,878	
Aircraft parts and accessories, except tires	21,583	
	$253,161	$ 60,218

What may interest the reader particularly is the classification of materials which are considered as armament. Some of the categories, of course, are essentially military. For instance all will concede that revolvers, pistols, machine guns, heavy ordnance guns and carriages, metallic cartridges are, or may be, according to the use put, armament as such. The others can be used by military forces but so can a thousand and one other

things. If shot shells, engines for aircraft, aircraft parts, are to be included why stop there. Automotive trucks and passenger cars, railway equipment, food, clothing, medical supplies, radio equipment, machinery, raw materials—everything that an army uses—should be stopped also. In other words, if we are going to try to stop war by embargo, the blockade should be complete. It should include everything. Why prevent the shipment of smokeless powder (of which $316 worth was exported to the two countries during the fifteen months period) and continue the shipment of cotton, nitric acid and alcohol? If we are determined to make other people stop fighting for what both sides seem to believe to be a just cause then we might be consistent and stop dealing with both sides in every commodity of every kind, food included. In this way the thing might work; starvation would certainly be effective. A determined people can fight for what they think to be justice without machine guns, without rifles, without all kinds of modern armament just as people did wage war before there was such a thing as modern armament. But they cannot fight when they starve or when medical supplies are lacking. So this experiment to be successful purely from the standpoint of stopping a war might go the whole way if indeed world opinion and actions mean to be thorough in their well-intentioned effort to make people behave as other people think they should.

The Chamber of Commerce Referendum

THE Chamber of Commerce of the United States did a very commendable thing several months ago when it submitted the report of its Special Committee on National Defense to a referendum by the individual and associate members of the organization. Under the By-Laws of the Chamber all subjects considered or acted upon are national in question, timely in importance and general in application to business and industry. This report by the National Defense Committee is one of those sane exhaustive discussions which will appeal to every fair mind. Indeed, when presenting a report of this nature for an expression of approval or disapproval by the members he who will cast his ballot is not confronted with a partisan statement of the question; on the contrary he is given the complete arguments on the positive and negative sides. Friends of the Chamber of Commerce who know of the important studies which its Committee on National Defense has made in years past are familiar with the broad sound lines which have characterized its activities for many years. This latest report and referendum carry on the splendid tradition.

In this referendum twelve propositions were placed before the members of the Chamber. Each organization casts as many votes as it may have delegates at an annual meeting of the Chamber. The number of delegates an organization may have depends upon the number of its members but in no case falls below one or exceeds ten. The result of the balloting showed a preponderant if not almost unanimous approval of the twelve propositions submitted. Naturally they included, as first in importance, propositions concerning our first line of defense, the Navy. So we find the first six in consideration of this and allied subjects, the seventh relating to an American-owned merchant marine and the five concluding propositions concerned with the Army and with industrial preparedness.

It will be of interest, we believe, to place these twelve propositions in the record in detail. They were: 1. The United States should continue support of the principle of limitation of armaments by agreement; 2. In agreements for limitation of naval armament the United States should obtain assurance of a fleet adequate to protect our shores, our territories and possessions, and our foreign commerce to an extent equal to that enjoyed by any other power; 3. The United States should maintain its fleet in relation to the fleets of other contracting powers at the ratio established in agreements for limitation of armament; 4. Within the terms of agreements for limitation of armaments the United States should systematically program all naval construction and modernization; 5. The United States should at all times maintain naval personnel needed for efficient operation of all component units of existing naval vessels; 6. The United States should continue the policy of training reserve personnel sufficient to meet all demands for Navy personnel in the event of war; 7. The United States should give continued support to the upbuilding and maintenance of an American-owned merchant marine suitable and adequate as a naval auxiliary in the event of war; 8. The United States should maintain the principles of Army organization embodied in the existing national defense laws, calling primarily for a small active military force to serve, with the National Guard and the Organized Reserves, as the nucleus of a large citizen army in case of emergency; the United States should make provision each year for the National Guard and reserves adequate to meet the objectives of the national defense laws; 10. The United States should undertake to maintain a systematic program for modernization of Army equipment; 11. The United States should have systematic planning for reserves of war materials and for industrial mobilization, with amendment of the National Defense Act to permit educational orders for equipment, munitions, and accessories; 12. Within the terms of agreements for limitation of armaments, the United States should pursue a systematic program of building and maintaining air services in the Army and in the Navy adequate to attain the objectives of the national defense laws.

Everyone will grant that these twelve points are of vital concern to the nation as a whole. Our particular interest, namely industrial preparedness, finds a sympathetic and logical approval in proposition No. 11 wherein the Chamber urges systematic planning for reserves of war materials and for industrial mobilization and for an amendment of the National Defense Act to permit educational orders for equipment, munitions and accessories. On this proposition 1859 votes were cast in favor of the Committee's recommendation; 27 votes were opposed. In the words of the report ". . . . We must do everything possible in peacetime to enable industry to develop this process (i.e. of education) for each type of equipment which we expect it to produce."

We congratulate the Chamber of Commerce of the United States on its constant interest in the broad questions of national defense. Speaking for organized industry, as the Chamber does, its understanding of the munitions problem in time of war and its effort to assist in industry's preparation in time of peace are great national assets. Students of the question who are not misled by blatant theorists will be grateful that this cross-section of American industry has a voice expressive of sound doctrine. This doctrine, when necessity requires its transformation into practical application has an untold value.

"*Facts*" *About Munitions Makers, II*

An Editorial

MUNITIONS makers, all and sundry, are war-mongering conspirators according to a great many writers whose sensational copy is eagerly sought by the daily and periodical press these days and according to a great many speakers whose fevered words are given full faith and credit. It may be of current interest to see what is the starting point of these ladies and gentlemen of the written and spoken word. On what do they base this attack? What is the origin of their sweeping indictment? Many of them will tell you that a League of Nations Commission in 1921 concluded, after investigation, that armament makers: 1. Foment war scares; 2. Attempt to bribe government officials; 3. Play one country against another to bolster business; 4. Seek to influence public opinion by control of the press; 5. Organize international armament rings; and 6. Rig the price of armament through international combines. (Hereafter in this editorial we shall refer to these alleged charges as "the famous six.") So the argument usually runs as follows. Major premise: individuals and firms who do such things, the famous six, are war-mongering conspirators—which premise, obviously is quite correct. Minor premise: but armament makers do these things according to *conclusions* of a League of Nations Commission in 1921 based on evidence submitted—which premise, as we shall see, is false. Conclusion: therefore armament makers are war-mongering conspirators. The logic is good in form but a gigantic hoax in substance because the minor premise *i.e.,* that the League of Nations Commission came to these conclusions, is not true. *The League Commission came to no such conclusions.* The Commission's report clearly says so and Great Britain's Secretary of State for Foreign Affairs recently called public attention to the misrepresentation of the report by certain propagandists. Here are the facts.

On April 18, 1934, in the British House of Commons, Sir John Simon, Secretary of State for Foreign Affairs of Great Britain, in answer to a question, established without doubt the misrepresentation that is being made of the League Commission's report. And this misrepresentation is the basis of nearly every attack on "munitions makers" which is now flooding the United States and Europe. Strange to say, this hoax has been accepted as true by responsible spokesmen in legislative, journalistic, educational and ecclesiastical circles. Strange too that leaders of thought in these important fields should not have consulted the League's report to see for themselves just what it contained! Stranger still if any of them did consult the report and still persist in spreading the hoax. However that may be, let us get back to the repudiation of the charges by Sir John Simon.

THE incident in the House of Commons to which we have referred is reported in the Official Report of Parliamentary Debates, House of Commons (Hansard) April 18, 1934. We quote from the Official Report:

"Mr. Denville asked the Secretary of State for Foreign Affairs if he has read the *charges made in evidence** before the Committee of the Second Assembly of the League of Nations declaring that bribery had been offered to Government officials both at home and abroad; and if he will ask the League to publish the names of the firm and of the officials?

"Sir J. Simon: My hon. Friend is referring to a report made at Geneva 13 years ago and on examining it I can find no reference to evidence having been given. My hon. Friend's question seems to be *based on a widespread misapprehension, and I should like to make plain to the House the source of the error.* In a green-covered pamphlet entitled "The Secret International Armament Firms at Work," and extensively circulated in this country and abroad, there appears on page 5 the statement that in 1921 a League of Nations Commission, which had been appointed to inquire into the problem of the private manufacture of arms, came to six conclusions in condemnation of the system and the second conclusion is the one quoted in my hon. Friend's question. *In point of fact the League of Nations Commission came to no such conclusions,* but on the contrary produced a report—I have it here—in which they set out a series of general considerations both *pro* and *con* on the subject and in view of the difficulty of arriving at recommendations in the face of these contrasting considerations concluded that it was unable 'to reach a final conclusion upon the difficult and complicated topic submitted to its consideration. It cannot at the present stage of its deliberations either recommend the abolition of private manufacture or advise upon the particular steps to be taken to control it, should it be decided that on the balance of advantage private manufacture must be allowed to continue.'

"It is greatly to be regretted that in the pamphlet to which I have referred the League of Nations Commission's report should not only be *misrepresented* in that considerations are set out on the one side as though they were conclusions, but that it should have suppressed all reference to considerations on the other side and the plain statement of the League of Nations Commission that in these circumstances they did not recommend abolition. I am obliged to my hon. Friend for putting his question and hope that this answer will secure that no further circulation is given to such misstatements.

"Mr. Denville: Is the Foreign Secretary aware that this question was put down with the object of clearing up something which has been a source of annoyance for a considerable time? I consider the answer most satisfactory."

Thus is explained a misrepresentation which nearly every anti-munitions maker propagandist has either unknowingly accepted as true without consulting the original source for the fact or has knowingly misrepresented if the original source material was consulted. As Sir John has said, the League of Nations Temporary Mixed Commission on Armaments in its report of September 15, 1921, did not come to the six famous conclusions regarding armament firms which have been broadcast as conclusions of the Commission! The report itself said it could come to no conclusion!

THE green pamphlet to which Sir John Simon referred was first published in July, 1932 (bear the date in mind—it is significant), and has gone through seven impressions. The latest edition was brought out in January, 1934. It is published by the Union for Democratic Control, London. In the Union's annual report for 1930-31 one can get a fair idea

*Italics in all quoted portions of this editorial are by the Editor.

of the purposes of this organization. Mr. J. A. Hobson, Chairman of the Union's Executive Committee, says of the Union in the preface to the report, "It has done, and can do, work which none other of the societies concerned with Peace and Internationalism is doing." Mr. Hobson also quotes from an address of a late president of the organization before the General Council of the Union in 1915 as follows: "At any moment, circumstances may arise when the country will be faced with a clear-cut issue, with definite alternate policies upon which it will have to pronounce judgment. When that moment comes—as come it must—the U. D. C. must be in the position to take the field and to battle for the faith. When that moment arrives we shall have to organize big meetings, to flood the country with our literature, to put pressure upon every member of Parliament and upon every candidate for Parliament."

Now let us look at the green pamphlet. The very first sentence in the pamphlet reads as follows: "In 1921 a League of Nations Commission which had been appointed to inquire into the problem of the private manufacture of arms came to the following *conclusions.*" Then follow the famous six. "These," continues the pamphlet, "are definite charges and it is a pity that the evidence on which they were based has not been published!" One might observe here that in the light of the facts it is difficult to see how *evidence* which does not appear to have been taken could be published to support *conclusions* which were not arrived at! But no matter; this misrepresentation was the opening gun and, hoax or no hoax, the crusade was on. Not only was the pamphlet extensively circulated in England and in this country but it was augmented by a personal visit and speaking tour of one of the Union's speakers, Mr. A. Fenner Brockway, chairman of the Independent Labor Party of Great Britain, former member of Parliament in the Labor Government and author of "Bloody Traffic" and "Hungry England." One of his opening guns was an article, "Munitions Morality," which was published in *Maclean's Magazine* (Canada) on August 15, 1933. He appeared as author and speaker on many occasions and under various auspices. One of his addresses, "The Munitions Racket," was delivered in Washington, D. C., on November 29, 1933, at Mt. Pleasant Congregational Church under the auspices of the Women's International League for Peace and Freedom, Friendship Forum, and Washington Council on International Relations.

IT is interesting to note the construction which Mr. Brockway placed upon the action of the League of Nations Commission. He wrote, "I am not concerned in proving that American armament firms are particularly malicious in their readiness to profit by war, or particularly immoral in the methods by which they do it. The armament firms of all countries are alike. The *indictment* of armament firms has never been stated more succinctly than in the report of a sub-committee of the League of Nations appointed to enquire into the private manufacture of arms. Before reproducing the *conclusions* of this Commission allow me to meet a common misunderstanding about the League." Later follow the famous six. "And," wrote Mr. Brockway, "the Commission which published these *conclusions* did not publish the evidence upon which it reached them."

So the hoax was promptly taken up by other writers and broadcast to the winds.

It is surprising that very few writers whom one would expect to deal in facts on the question appear to have taken the trouble to consult the original thirteen-year-old Committee report. Rather they seem to have been content with the green pamphlet of the Union for Democratic Control because many of them, in addition to Mr. Brockway, have used substantially the wording of the pamphlet. For example, Clarence K. Streit, Geneva correspondent for the *New York Times,* in a signed article in the *Times* of November 20, 1932, referred to the League Commission's report in these words: "The League members began with some zeal. Their temporary Mixed Commission's first sub-committee came to the following *conclusions* in 1921." Then follow the famous six. Rev. Laurence K. Patterson in the June 3, 1933, issue of *America* used slightly different wording. He wrote that the Commission *declared* that the armament firms engaged in the famous six and referred to the Commission's report as "a formidable *indictment* from an authoritative source." Mr. John Gunther in the May, 1934, issue of *Harper's* magazine switched it another way. He wrote, "Every writer on the arms traffic I have encountered has enumerated the *charges* outlined by the League's Temporary Mixed Commission in 1921." And he proceeds to put down the famous six. And so it goes. A sad commentary on the methods of propagandists who seem to be concerned only with gaining a point at whatever cost!

In the case of the Patterson article in *America* the writer of these lines publicly called attention to his use of this hoax. Whereupon the author publicly admitted "The Commission of 1921 did not *formally charge* the munitions makers with the six points; it stated that the *objections* raised could be concluded under six headings." He wrote further, that "The six points seem to be conclusively demonstrated by the article 'Arms and the Men' published in the March issue of *Fortune!*" This brings the evolution of the attack on "munitions makers" into its next phase. Let us consider it a little.

WE made clear, we hope, in our last issue the factual condition of the operations of some of our "munitions makers" in the United States during the past ten years. We showed factually the absurdity of any inference that there is an ordnance industry as such in this country and the serious plight of our own national defense in this respect. We made clear also that this Journal is the spokesman for no company or no individual here or abroad; in the interest of truth we published facts which anyone sufficiently interested in facts could have obtained. We hold no brief for unethical practices by anyone anywhere. If there are any individuals or any companies engaged in sharp practices in the manufacture or sale of armament we do not countenance them for one moment. But we do not subscribe to the charge that "munitions makers" per se here or abroad are the war-mongering conspirators they are represented to be. Indeed, as Mr. William R. Castle, Jr., former U. S. Under Secretary of State, has said in proposing a method for control of armament manufacture, "There would always be individuals who would cheat, manufacturers who would permit the thought of profits to kill their conscience, but these would be few in number, just as it is true today that by and large the munitions makers are just as honorable as any other manufacturers." (*New York Herald Tribune,* June 10, 1934.) It would be just as illogical and as unfair to damn all butchers, bakers and candlestick makers if it were found that a butcher here or there misrepresented skinless frankfurters, or a baker here

or there consistently acted on the belief that eleven buns constituted a dozen, or an occasional candlestick maker was actually making a trick container for tax-free spirits.

As we do not speak in the name of arms producers in the United States quite naturally we do not speak for those abroad. Yet fair play demands that the facts so far as we know them be presented. So let us consider the facts in refutation of the charges that are being circulated with regard to two of the leading "offenders" abroad. We refer to Vickers-Armstrongs, Ltd., of England and Francois de Wendel & Cie of France. Fairness demands that the following be published although—and we repeat it—the European situation is not our concern. The following official statement by Vickers-Armstrongs, Ltd., was made public in February, 1933. It was published in full in the *London Times* of February 9, 1933. (Note the date!) It reads:

"The attention of Vickers, Limited, has recently been directed to certain misleading articles in the Press of various foreign countries implying control of subsidiaries and association with certain foreign firms with whom it has either no connection or merely an investment.

"Vickers, Limited, is now a holding company and its manufacturing interests are confined to the following groups: 1. Armament, shipbuilding, steel and engineering (through Vickers-Armstrongs, Limited). 2. Rolling stock (through Metropolitan-Cammell Carriage, Wagon and Finance Company, Limited). 3. Aviation (through Vickers (Aviation), Limited). 4. Sundry British industrial undertakings wholly controlled by Vickers, Limited.

"Vickers-Armstrongs, Limited, resulted from a fusion of the shipbuilding and armament interests of Vickers and Sir W. G. Armstrong, Whitworth and Co., and its main subsidiary is the English Steel Corporation, which was a combination of the steel interests of Vickers-Armstrongs with those of Cammell Laird and Co. It has one small subsidiary company in Spain, and its only other foreign investments consist of minority holdings in companies in Spain, Japan, and Rumania. Vickers-Armstrongs are not in any way associated with other companies in the Armstrong, Whitworth group, such as Sir W. G. Armstrong, Whitworth and Co. (Engineers), Limited, and Armstrong Siddeley Motors, Limited, etc.

"Metropolitan-Cammell Carriage, Wagon and Finance Company resulted from a fusion of the rolling-stock interests of Vickers and Cammell Laird.

"Vickers (Aviation), Limited, comprises Vickers (Aviation), Limited, and its subsidiary, Supermarine Aviation Works (Vickers), Limited, and has no foreign associated concerns.

"Possibly some misunderstanding as to the financial interests of the Vickers group is attributable to the fact that companies formerly owned by Vickers, Limited, and bearing 'Vickers' as part of the name have been sold without any alteration in the title of the company. In 1926 Vickers sold the whole of its interests in Canadian-Vickers, Limited, but that company still carries on business in Canada under its original name.

"Similarly Vickers disposed of its control in Metropolitan-Vickers, Limited, which is now one of the constituent companies of Associated Electrical Industries, Limited. Although Vickers have acquired shares in A. E. I. as an investment, they have only a minority interest, with no participation in control or management. Vickers-Armstrongs, Limited, are not interested in any way in Metropolitan Vickers, Limited.

"Vickers have a minority holding in Vickers-Commonwealth Steel Company in Australia, but do not control that undertaking. Vickers (Ireland), Limited, is, however, a subsidiary of Vickers-Armstrongs, Limited.

"The extravagant assertions made from time to time as to the ramifications of the Vickers combine in different parts of the world and their association with Skoda, Schneider, Bofors, and other armament firms have no substance in fact, as the policy of the board since the reconstruction of the company in 1925 has been to consolidate its manufacturing interests in the four groups mentioned.

"As Sir Herbert Lawrence—the chairman of the company—has stated at the annual general meeting on several occasions, the object of the Vickers Company is to employ its large liquid resources—about £6,000,000 sterling—in financing contracts for shipbuilding, engineering, and other manufacturing activities of the company's subsidiaries and to maintain its various establishments in the highest state of efficiency."

(Readers should note particularly that Vickers-Armstrongs, Limited, has no interests in Canadian Vickers, Limited, and further that the much repeated assertions that they are associated with Skoda, Schneider, Bofors, and other armament firms, have no substance in fact.)

THE charges that have been leveled in this country against Messrs. deWendel have brought forth from their company Les Petits-Fils deWendel a printed refutation which also in fairness should be placed in the record. We regret that lack of space prevents the inclusion here of the statement in its entirety. The published refutation first refers to the alleged indifferent use by Messrs. deWendel of the French prefix *de* or the German prefix *von* before their family name according to whether they are dealing with French or Germans. "This assertion," continues the statement, "is false and Messrs. deWendel have never used before their name the prefix *von.*" (It seems very childish that reputable men must indulge in this sort of denial. Yet it is just this kind of claptrap in the sensational charges making the rounds in this country that have taken hold of readers' imaginations. These French gentlemen do well, therefore, to refute the insinuations regardless of their seeming triviality.) The statement continues, "At no time have Messrs. deWendel hidden their French sentiments which were well known to the German government" and when "they are referred to as German nationalists this assertion is so notoriously contrary to facts that it alone betrays a hostile intention or an absolute ignorance of the question."

The detailed refutation of the deWendels (printed copies of which can be obtained from the company) can be summarized as follows: a. The deWendel Works, dating back to 1704, *have not for more than 120 years ever manufactured war material nor have they at any time manufactured guns;* they are in no way interested industrially in the development of armaments and owing to the geographical situation of their works have everything to fear from an armed conflict which would imperil all their means of production. b. The legend that the Briey Basin was systematically spared from bombing by Allied air forces during the war is inaccurate; *Allied raids were made on the Hayange and Moyeuvre works although they belonged to French citizens whose sentiments for France were well known; the Joeuf works*

were systematically destroyed and several years and many millions were required to reconstruct them. c. As to the charge that the firm having interests in France and Germany banked on both sides during the World War, the facts are, according to the statement, that while fulfilling in France all their duties toward their country during the war, all their industrial interests, metallurgical undertakings, collieries in annexed Lorraine and interests in invaded territory were in the hands of the enemy. d. "As for having secured profits through the war with which one has often pretended to reproach them, they need not even trouble to deny it, everyone knowing that the first result of the war was to deprive them of all their works: their French works were destroyed and their works in Alsace-Lorraine or in Germany were sequestrated, requisitioned and finally sold as enemy property." e. The statement concludes with a genealogy of the family and the record which has brought it honors in war and in peace.

ONE further significant fact should be brought to general attention at this time. On June 15, 1934, the United States Senate ratified an international convention for the supervision of the international trade in arms and ammunition and in implements of war signed at Geneva June 17, 1925. This is a forward step in the right direction. We propose in the next issue of this Journal to publish the treaty in full. It will be remembered that the late Brig. Gen. Colden L'H. Ruggles, then Assistant to the Chief of Ordnance of the United States Army, and Army Ordnance Association medalist in 1932, was a member of the American Delegation to the Conference which during its sessions of 45 days drew up the regulatory convention. In the words of the chairman of the delegation, "The people of the United States earnestly desire to give substantial evidence of their sincere interest in aiding in any constructive effort directed toward the maintenance of peace and it is hoped that such efforts will be promoted by the proper control of the international trade in arms through the suspension of illicit trade in war material and by securing the fullest and most accurate publicity as to the extent and character of this trade." The treaty merely confirms and makes more definite the policy and practice now prevailing in the United States. As the chairman of the American Delegation further stated, "Our part in the international trade in arms has not been large during the past few years and the policy of the Government, already outlined, has helped to keep it within proper channels."

The treaty in articles 1 to 5 defines the several categories of arms, ammunition and implements of war and places their control under each sovereign state within its own territory according to its own laws. It further provides a system of publicity for the international trade generally with special control with respect to certain areas in Central Africa and the territory formerly a part of the Ottoman Empire. The instrument does not become effective until it has been ratified by thirteen arms producing powers. When the United States Senate ratified on June 15th its resolution of ratification contained a reservation "that the said convention shall not come into force so far as the United States is concerned until it shall have come into force in respect to Belgium, the British Empire, Czechoslovakia, France, Germany, Italy, Japan, Sweden and the Union of Soviet Socialist Republics."

As we see it, this treaty when effective is of far more consequence to other countries than it is to the United States. We already have a system of publicity in this country although the treaty provisions are somewhat more definite than our present practice. Those who see a sinister influence at work by our "munitions makers" probably do not know that the Bureau of Foreign and Domestic Commerce of the U. S. Department of Commerce issues monthly a statement of statistics entitled "United States Exports of Firearms and Munitions of War." It shows the quantity and value of our exports to all countries of revolvers and pistols, rifles, shotguns, machine and heavy ordnance guns and carriages, shot shells, metallic cartridges, explosive shells and projectiles, and other ammunition including fireworks. So we are already performing in fact what the treaty requires. Indeed no student of the subject will object to publicity of this sort and manufacturers concerned are, we feel sure, of the same viewpoint. Our manufacturers have been quite willing to abide by reasonable and constructive steps in this matter.

THE most recent evidence of this attitude is shown by the Code of Fair Competition for the Small Arms and Ammunition Manufacturing Industry approved by the National Recovery Administration March 22, 1934, from which we quote the following: "Members of the Industry shall have the right to sell or otherwise dispose of machine guns or sub-machine guns or parts therefor only to the United States Government, any State, Territory, or possession of the United States, and political sub-division thereof and the District of Columbia; provided that with the consent of the United States Attorney General they may be disposed of to National, State banks or to corporations or other business associations having regularly organized police departments, and to manufacturers of ammunition in the United States for testing purposes; provided further, that such members shall have the right to sell machine or sub-machine guns or parts thereof for export under such rules and regulations as may be promulgated by the United States Secretary of State."

Thus we see that the general attitude of those concerned is a wholehearted one. By the same token we might observe that the campaign of vilification now sweeping over the country may have some sinister purpose behind it.

What then can one conclude of the campaign that is being waged against so-called "munitions makers" in the United States and abroad? The evidence here adduced is ample warrant for the conclusion that the attack is a campaign of misrepresentation of fact and, as it is being conducted by some spokesmen, on defamation of character. Its proponents have not always gone to authentic sources for their information, or if they have, then they have deliberately misrepresented facts. All of which is a sorry commentary on the methods being used to weaken national defense.

Let us again express the hope that the Committee of the United States Senate under the chairmanship of Senator Nye appointed to investigate the munitions industry in the United States will, by its fairness and impartiality, bring to the attention of the people of our country the complete factual story of American munitions today. There was never a time when fairness and common sense based on fact were so greatly needed. (*This editorial is being reprinted in pamphlet form. Copies will be sent without cost to any one interested in having them. Reprints of the first editorial in this series, "Facts About 'Munitions Makers'" are also available without cost. Requests for copies of either or both should be addressed to the Secretary, Army Ordnance Association.*)

Association Affairs

NOMINATIONS FOR A. O. A. OFFICERS AND DIRECTORS

MR. PHILIP H. GADSDEN, President of the Philadelphia Post of the Association, acted as chairman of the Nominating Committee to select nominees to succeed the officers and three of the directors whose terms of office expire December 31, 1934. The other members of the Committee, appointed by the President of the Association in accordance with the Constitution, were Henry B. Machen, vice-president of the New York Post of the Association; A. H. Pugh, president of the Cincinnati Post; Alex. K. Hamilton, president, Chicago Post; and Charles N. Black, vice-president of the California Post.

The Committee has presented its report which unanimously nominates all present incumbents. The nominees are: for president, Brig. Gen. Benedict Crowell, Ord. Res., of Cleveland, Ohio; for vice-presidents, Col. Wm. W. Coleman of Milwaukee, Wis., and Col. W. C. Spruance of Wilmington, Del. The term of office of the president and vice-presidents under the Constitution of the Association is two years; *i.e.*, until December 31, 1936. The nominees for directors are Maj. Gen. C. C. Williams, U. S. A., Ret., of Washington, D. C.; Brig. Gen. Samuel McRoberts, Aux. Res., of New York, N. Y.; and Mr. Pliny E. Holt of Stockton, Calif. The term of office for these directors is four years; *i.e.*, to December 31, 1938.

Ordinarily short biographical sketches of all nominees would be published at this time for the benefit of members. All these gentlemen, however, are well known to the entire membership. Indeed they have been towers of strength in the ordnance cause since the World War. To them and the other officials and directors whose terms have not yet expired are due the founding of the Association in 1919 and its successful record of achievement since then.

The election of officers will be by general ballot in accordance with the constitutional provision. Ballots will be mailed before July 31st to all members entitled to vote. Polls will close at noon September 4th.

ORDNANCE SCHOLARSHIP HONORS

THE A. O. A. HONOR KEY FOR SCHOLARSHIP

AS a mark of honor and congratulation to the young men who this year completed with distinction the courses in the R. O. T. C. Ordnance Units, the Army Ordnance Association made available gold fraternity keys "for scholarship." In some cases these honors were awarded prior to commencement exercises and in others at the annual inspection by corps area authorities. ARMY ORDNANCE extends its felicitations to these honor men and hopes that the insignia conferred upon them will be a reminder in after years of the importance placed upon their work as members of the Ordnance R. O. T. C. These young men are the ordnance executives and leaders of tomorrow and upon them rests the obligation to continue their interest in time of peace in order that they may be the better enabled to fulfill their emergency assignments if the need should ever come.

At Stanford University, Calif., the awards of the A. O. A. keys were made by Brig. Gen. S. A. Cheney who represented General Craig, the Corps Area Commander, at the annual inspection May 2nd. The entire Ordnance Unit witnessed the presentation and the ceremony was very impressive. The awards were conferred upon Richard Eaton and George Wilson, the outstanding senior and junior advanced course students, and were for excellence in scholastic work in both military and general University subjects for the current year. Capt. I. A. Luke, Ord. Dept., is on duty with the Department of Military Science and Tactics at the University.

At Cornell University the awards were made by Capt. G. W. Hirsch, Ord. Dept., of the Military Department, following the President's Review May 31st. The recipients were Robert Jackson Belknap, a senior in the College of Civil Engineering, and Jean Fischer Mitchell of the first year advanced course.

At University of California the keys were conferred at the traditional President's Review when the President of the University with other dignitaries receives the review of the entire Cadet Corps. In addition to President Sproul the following were in the review line: Maj. Gen. David P. Barrows, Commanding General, 40th Division, California National Guard; Rear Adm. Thomas J. Senn, Commandant of the 12th Naval District; Brig. Gen. Charles S. Lincoln, representing the Commanding General of the 9th Corps Area; Col. H. LaT. Cavenaugh, Cav., and Capt. F. Gygax, U. S. N. The Ordnance Company led the Corps at the review. The A. O. A. key for scholarship in the graduating class was presented to James Francis Ryan, Jr, honorary Cadet Lieutenant Colonel of the Corps, the highest honorary rank in the Ordnance Unit, the Cadet Colonel being selected from Infantry and Coast Artillery units. Cadet Ryan's average grade for the two years of upper division ordnance work was 92.5. His average grade for four years of military, including two years of basic Coast Artillery, courses was 89.7. Another key will be awarded to the honor student at the end of the 1934 Fall semester. Capt. S. R. Stribling, Ord. Dept., is in charge of the Ordnance Unit at University of California.

Frederick S. Kohl, a member of the senior class, and Delbert P. Hesler of the junior class were the recipients of the awards at University of Michigan. Cadet Kohl was the Cadet Colonel of the R. O. T. C. regiment this year; both were outstanding students in the Engineering College of the University. The awards were presented by Capt. A. B. Custis, Ord. Dept., of the Department of Military Science and Tactics at Ann Arbor.

Awards to members of Ordnance Units at other institutions will be made in some cases at graduation and in others at the beginning of the Fall semester.

MEETINGS OF LOCAL POSTS

DURING the past few months important meetings of local chapters of the Association have been held.

At a joint meeting of the St. Louis Post and The Engineers' Club of St. Louis which was held on April 12th at the Lindell Boulevard home of the Engineers, Maj. Ralph G. Nichols, Ord. Res., presented an illustrated lecture on "The Development of Military Arms." Lieut. Col. W. C. Bliss, Ord. Res., presented the speaker and outlined the mission and aims of the Army Ordnance Association, and appealed to the Engineers for a continued interest and better understanding of the problems of industrial preparedness.

Major Nichols' subject was in two parts. The first part covered the period from the 14th century which saw the earliest attempts to use explosives as a propellant up to the beginning of the present century and the universal adoption of breech-loading cannon, smokeless powder propellants and repeating shoulder arms. The second part covered post-war developments from the end of the World War to date. The first part of the lecture was illustrated with the help of a blackboard on which Major Nichols sketched details of the early weapons starting with the "hand gonne" of the 14th century, an iron or brass tube having a touch

hole and a straight wood stock, and ignited by means of a burning hemp cord held in the hand.

There followed a description and illustration of the evolution of the lock showing first the hinged cover over the primer cup to protect the contents from rain and wind. Next the "S" shaped cock called the Serpentine for carrying the hemp cord, followed in order by the wheel lock, driven by a coil spring and using iron pyrites on a roughened wheel; the snaphance using flint clamped to the cock; the flintlock of Revolutionary days; the steps in the development of the percussion lock, and the early attempts at rifling and breech loading. The history of cannon was traced from the early wrought iron tubes of the 14th century to the period of the World War. It was shown that cannon developed in three general periods or epochs. The first from 1313 to 1520, wrought iron cannon using stone shot; the second, 1520 to 1854, cast iron and bronze cannon, using cast iron shot; and the third, 1854 to the World War, rifled guns of wrought iron or steel using an elongated shot or projectile.

A comparison was made of artillery ammunition expended during the American Civil War and the World War wherein it was shown that in one year of the Civil War 1,950,000 rounds were used compared with 152,515,000 rounds used for one year of the World War. The total cost was in the ratio of one dollar for the Civil War to three thousand dollars for the World War.

The second part, which was illustrated with slides, covered post-war development of the weapons recommended by the Caliber Board in its report of 1919. The outstanding features of this development were shown to be increased efforts toward perfection of an automatic shoulder arm, increased mobility and range of field cannon, and particularly the development of antiaircraft weapons and fire-control instruments and methods.

THE annual meeting of the New York Post was held on April 20th in the ball room of the Governor Clinton Hotel, New York, N. Y. General Samuel McRoberts, president of the Post and chief of the New York Ordnance District, was the presiding officer. Lieut. Col. Lucian D. Booth, Ordnance Officer of the 2nd Corps Area, was toastmaster. The honor guests were Maj. Gen. Samuel Hof, retiring Chief of Ordnance, and Brig. Gen. William H. Tschappat, Chief of Ordnance designate.

The principal address was delivered by General Hof who was presented by Brig. Gen. John Ross Delafield, Counsel of the Association and former Chief of the New York Ordnance District. Other speakers, in addition to General Tschappat, were Col. James L. Walsh, Ord. Res., a former chief of the New York Ordnance District, and Maj. L. A. Codd, Ord. Res., Executive Secretary of the Association.

General Hof's address was in the nature of a self-styled "swan song" from which the following excerpts are quoted:

"Although I know you are all familiar with its history, I should like to say a few words about the New York Post. This group broke the trail in those post-war years when there were no precedents to go on in determining just how the relations between the Army and the civilian manufacturing industry under the changed conditions of modern war might best be maintained. The general concept of those relationships was embodied in the constitution of the Army Ordnance Association. The determination to create the New York Post registered the belief that the goals of the Association could best be attained by the local consolidation of groups of individuals who had taken part in the war activities of the various industries or who were concerned that the nation be prepared to solve its manufacturing problems in any future emergency. To such local groups were soon added those whose interests extended on into matters concerning the distribution of munitions to combat troops.

"Having determined to carry on its activities through local posts, it was quite natural that the Army Ordnance Association should select New York for the honor of establishing the first post. In many ways the New York area is unique. The industries carried on within the metropolitan area represent industrial activity greater than that of entire nations. Its shipping and transportation interests make it the nerve center of the immensely complicated system by which we effect the exchange of commodities on which the nation lives. Its financial preëminence insures that here at least, financial support may be obtained for any manufacturing or industrial project which is soundly conceived to meet the needs of our population in peace or which is requisite for a war effort. The many important research laboratories maintained in this area by large corporations, the museums, the technical libraries, and technical experts residing here, insure that New York leads in the scientific field which is of importance to us in keeping abreast of science in our design and manufacturing methods. This same opportunity is, of course, realized by the numerous technical and professional societies which have located their headquarters here and who in turn have been of the greatest assistance to us in their cordial coöperation. . . . .

"In the reorganization of the Federal agencies the present organization for procurement is undergoing some change. There has been established in the Treasury Department the Procurement Division to supervise procurement for all government agencies. This division is interested in the coördination of procurement throughout government departments with a view to obtaining the most satisfactory supplies in the most economical manner.

"Now, as you know, supervision and control of our current procurement in the War Department is charged to the Assistant Secretary of War under the authority of the National Defense Act. Actually the Assistant Secretary functions in the rôle of coördinating the many interests of the several branches of the War Department. He must be assured that the purchases made by one department are of material which is suitable to be used with the material which another branch procures. For example, if the Ordnance Department requires a heavy motor vehicle for a certain military organization it must be within the weight limit prescribed for the bridge equipment accompanying that organization.

"The Assistant Secretary is interested not only in the procurement of military supplies, whether they be by purchase or production, but he is also interested in the facilities which are used in their production, the methods which are used in purchase, as well as the specifications under which purchases are made. His coördinating and supervisory functions are, of course, further complicated by the various codes which have been instituted by N. R. A. and these complications are confusing to the individual branches and down to the actual contracting officers. The coordinating control of the Assistant Secretary of War is very definite and we are required to submit our plans for the procurement of any items of equipment for troops to the Assistant Secretary for approval before the actual steps are initiated. This is necessary for coördination between branches, both as to the type of material being purchased and for the methods being used.

"In the Office of the Chief of Ordnance the Manufacturing Service is charged with the supervision of procurement. Normally all procurement is decentralized and is done by the various arsenals and depots, according to the types of matériel which can be best handled by the particular arsenal or depot. However, from time to time the Washington office makes contracts for important items of equipment. For example, recently contracts were made for certain items of automotive equipment. One of the duties, of course, is to carry out the law and the instructions and policies which come from the Assistant Secretary of War and now also include the codes of fair competition established by N. R. A. . . . . .

"From this brief résumé you will readily see that our current procurement is thoroughly supervised and checked. The Ordnance Office supervises, the Assistant Secretary of War coordinates, N. R. A. supervises, and the opinion of the Comp-

troller General is not to be regarded lightly—and we might go further and say that the Congress is interested in a greater or lesser degree from time to time.

"Your new Chief of Ordnance, as you all know, is a very charming man, and I believe without doubt one of the best qualified ordnance engineers in the world. He would rather work out a complicated problem in calculus involving exterior ballistics than partake of even such a splendid dinner as we have had here. He would rather do either of these things or both than make a speech. You all know him well and he needs no praise from me. As my parting word, however, I earnestly ask that you give him the same complete coöperation which you have given me and which you gave to my predecessor, General Williams. With this assistance from you and General Tschappat's own extraordinary ability, we are assured of successful Ordnance progress during the next four years."

THE ranks of the Association have again been deprived through the death in recent months of several of its outstanding leaders.

WILLIAM H. WOODIN

Among these we record the passing of William H. Woodin, former Secretary of the Treasury, president of the American Car and Foundry Company, and member of the Advisory Board of the New York Ordnance District. Mr. Woodin died in New York May 3rd. While his public service at the time of the financial crisis of 1933 overshadows many of his other achievements, he will always be remembered as a leader of ordnance activities in the World War and in the post-war years. The company of which he was head was among those which valiantly undertook the production of ordnance in emergency establishing a record of performance by the prompt and efficient way in which it transformed its facilities from a peace to a war basis. Under the guidance of Mr. Woodin the company has continued its coöperation in industrial planning since the war. Its officials are rendering most commendable service in this important work. To them and to the country Mr. Woodin's death is a loss of a public spirited, talented and practical-minded citizen which every organization and every country can ill afford to bear.

TAYLOR ALLDERDICE

ANOTHER great loss to the ordnance cause was sustained in the death of Taylor Allderdice, vice-president of the Pittsburgh Post and former president of that organization, who died at his home May 13th at the age of 71. He was a prominent citizen of Pittsburgh and a leader in the civic and business life of the city for the past generation. He took up his residence in Pittsburgh in 1881 working as a rail driller in the mills of the National Tube Company. He became successively foreman, superintendent, manager and, in 1926, president of the company from which he retired two years later. This continuous service was interrupted only for a period during which he attended Lehigh University.

Mr. Allderdice was a trustee of the Carnegie Institute of Technology for many years. Since his retirement from active business he had devoted much of his time to the Carnegie Hero Fund Commission of which he had been manager and secretary since 1930. He was also identified with many business and philanthropic organizations of Pittsburgh. To his associates and the members of his family ARMY ORDNANCE extends condolences. The memory of his work in this, one of his many interests, will hold an honored place in the affections of his co-workers and in the record of their progress.

JOHN W. JARBOE

MR. JOHN W. JARBOE, a charter member and director of the St. Louis Post of the Army Ordnance Association, died in St. Louis March 22, 1934. He was elected a director at the inaugural meeting of the Post in January, 1927, and had retained that office continuously since then.

Born in Louisville, Ky., in 1860, Mr. Jarboe was associated with the C. C. Mengel, Jr., and Bros. Company, box manufacturers, for ten years prior to his becoming a resident of St. Louis in 1899. In 1901 when the Columbia Box Company of St. Louis was organized Mr. Jarboe became secretary and director and in 1912 he became president of the company.

He was actively interested in the Army Ordnance Association, the St. Louis Post and the Ordnance District and had participated in the studies and programs of all functions connected with these organizations, all of which have suffered a distinct loss by his death.

HUGH SMITH

THE Ordnance Department announces with deep regret the death of Mr. Hugh Smith, a former Watervliet Arsenal employee, on May 10, 1934, at Albany, New York, following a six months illness.

Mr. Smith was seventy-four years of age and had been a resident of Watervliet and Albany since 1894 when he reported at the Arsenal as a representative of the Pond Machine Tool Company of Plainfield, N. J., as foreman in charge of the installation of certain large machine tools for the manufacture of seacoast cannon in the newly erected south wing of the seacoast cannon shop. Following the completion of that project he entered the service of the Ordnance Department as foreman of the shop, retaining that position until the World War, following which he served as superintendent of shops and miscellaneous duties until his retirement on May 17, 1926.

Mr. Smith was born in England and after completing a seven years apprenticeship as machinist came to this country. He was one of the outstanding, loyal, trustworthy employees of Watervliet Arsenal and had a most enviable service record. As a former Commanding Officer said of him, "he was recognized as one of the leading American authorities on heavy cannon construction."

NEW MEMBERS

THE following have been admitted to membership in the Army Ordnance Association since the last issue of ARMY ORDNANCE: S. G. Barnard, Camden, N. J.; W. O. Boian, Des Moines, Iowa; Fred J. Braucher, Akron, Ohio; Harold J. Conway, Fort Crockett, Texas; Richard Z. Crane, Springfield, Mass.; Ira B. Cross, Jr., Berkeley, Calif.; W. J. Crowe, Aberdeen Proving Ground, Md.; Charles P. Day, New York, N. Y.; Jack J. Driscoll, New York, N Y.; John M. Green, Franklin, Tenn.; A. C. Haushammer, Madison, Wis.; Andre Jandot, New York, N. Y.; James A. McDonnell, New York, N. Y.; J. D. McIntyre, Birmingham, Ala.; H. P. Mee, Peoria, Ill.; Andrew M. Moore, Tulsa, Okla; Bruce Pierce, Three Rivers, Calif.; F. Plemp, Columbus, Mont.; Charles B. Robertson, Oakland, Calif.; Frank L. Root, Stanford University, Calif.; William H. Snair, Connellsville, Pa.; Kermit J. Soderberg, Stockton, Calif.; H. W. Tschudin, Philadelphia, Pa.; Stephen Van Rensselaer, Peterboro, N. H.; Carl Viale, Brooklyn, N. Y.; Harold Ward, New York, N. Y.; Theodore Welker, Belvidere, N. J.; Theodore R. Wieseman, Milwaukee, Wis; Arthur Willink, Philadelphia, Pa., and Sam T. Woods, Webster Groves, Mo.

NECROLOGY

SINCE publication of the last issue of ARMY ORDNANCE notice has been received of the death of the following members of the Association: Maj. Gen. F. C. Ainsworth, U. S. Army, Ret., Washington, D. C.; William Coyne, Wilmington, Del.; T. J. Gillespie, New York, N. Y.; Henry Moakley, New York, N. Y.; and Henry H. Olmstead, Wharton, N. J. To relatives and friends ARMY ORDNANCE, for its readers, extends condolences.

Professional Notes

Jefferson Davis' Ordnance Manual

AFTER an absence of nearly 69 years, President Jefferson Davis' *Ordnance Manual* went back to Richmond, on a visit.

Lieut. Col. LeRoy Hodges, State Ordnance Officer of the Virginia National Guard and Chairman of the Association's Committee on Membership, in connection with the preparation of his "Ordnance Notes" for *The Virginia Guardsman*, recently was loaned the ordnance manuals of the Civil War period. When they arrived in Richmond, Colonel Hodges was surprised to find among them a copy of "The Ordnance Manual for the Use of the Officers of the Confederate States Army," 1st Edition, prepared under the direction of Colonel J. Gorgas, Chief of Ordnance of the Confederate States Army, printed by Evans and Cogswell, Charleston, South Carolina, in 1863. When he glanced at the flyleaf, however, and noticed the inscription he was amazed.

Here, in the handwriting of Colonel Gorgas, is written: "For His Excellency The President." Below these lines, in pencil, is the signature of Jefferson Davis. The next two lines, written by Colonel Gorgas, read: "Ord. Officer, Richmond, Apr. 15/63." Below was the endorsement, in another handwriting: "Presented to the O. O. by Capt. Norris, 2nd U. S. Cavy., June 2nd, 1865."

This was the personal autographed copy of the Confederate *Ordnance Manual* that was presented to President Jefferson Davis of the Confederates States of America by his Army Chief of Ordnance immediately after it was printed in 1863.

This book, as indicated by the endorsements it contains, was taken from Richmond after the evacuation in 1865; and, within sixty days, was presented by a Union officer to the Ordnance Office of the War Department at Washington. Richmond was evacuated on April 2, 1865, and the Confederate President's manual was delivered in Washington on June 2, 1865. It is interesting to note in this connection that it was an officer of the Second United States Cavalry who took this book away from Richmond, a member of the same outfit that opened the fighting in Virginia at Fairfax Court House on June 1, 1861.

The autographed Preface of this interesting volume reads as follows: "This Manual is adopted, with some necessary changes, omissions, and alterations, from the Ordnance Manual of the United States service of 1861, prepared under the immediate direction of Major Laidley. The material of the two services is, of course, nearly identical, differing only in the shape of the new Columbiads and the Rifle Guns, and the addition to our service of the Mountain Rifle of 2.25-inch.

"It may be added that the labor of Ordnance officers now in the service of the Confederate States, has contributed to this new edition of the United States Manual. Ordnance Office, Richmond, Va., 1862. J. Gorgas, Col., Chf. of Ord."

Tanks in the Chaco War

THE following account is by the Commander of the Bolivian Tanks, a German officer. It was published in *Militar-Wochenblatt*, No. 40, April 25, 1934. The translation is as published in *The Army, Navy and Air Force Gazette*, London, May 17, 1934.

In January, 1933, part of the Bolivian forces were entrenched in a semicircle round two Paraguayan redoubts, "Nanawa" and "Ayala." Both positions were strong and well supplied with machine gun nests; some machine guns were placed up trees, but there was no wire, this not being necessary in view of the thorny nature of the forest. On July 4 the Bolivians attacked the very sharp Paraguayan salient, which projected westward, from north-west and from south; the Bolivian center was only to "demonstrate." Two medium tanks supported the right-hand attack; one medium and two light tanks were allotted to the left wing. The right wing consisted of three battalions (450 rifles and 20 machine guns apiece), one cavalry regiment (dismounted), six flame projectors, two 65-mm. guns, six 81--mm. Stokes mortars and the tanks. The left wing was approximately of the same composition and strength. A mine had been driven against a Paraguayan strong point in front of the left wing, a fact which was certainly known to the Paraguayans. The Paraguayans had numerous machine guns (with armor-piercing ammunition) but little artillery.

The Bolivian artillery consisted of three (7.5-cm.) mountain batteries, one (10.5-cm.) mountain howitzer battery, one (10.5-cm.) field howitzer battery, with two extra mountain and one infantry gun dug into the left wing trenches. At 8:50 A. M. 25 guns and 12 mortars opened the artillery preparation. The latter proved not very effective, very many enemy machine guns not even being touched. The Paraguayan artillery replied only at the beginning of the infantry fight. At 9.5 the mine was fired; although it exploded 100 feet short of the Paraguayan earthworks, its moral effect enabled the Bolivians to take the small redoubt which it should have blown up. Supported by the medium tank the Bolivians then tried to make further headway until at 11 A. M. the tank was disabled by a direct hit. By noon a small gain of ground had been made; but one light tank was out of action, while the second had upset.

On the right wing the tanks moved forward at 9.16, being followed by the infantry four minutes later. The tanks managed to take the Paraguayans' trench in enfilade and this was carried by the Bolivian infantry. But further progress was not great, although the tanks, by moving forward, drew out of the Paraguayan artillery fire. One tank pushed still further on, but owing to mechanical failure then withdrew. The second tank was struck by an armor-piercing bullet on the turret, which jammed; so it withdrew, repaired the damage and returned. Finally, after the whole crew had been wounded it withdrew again, followed by the leading machine.

In the afternoon the Paraguayans counter-attacked along the whole front. On the Bolivian right these attacks were finally thrown back and the Bolivians maintained their meager gains. On the left the attack was conducted in massed formation, whereupon the Paraguayans suffered heavy loss from machine guns. They succeeded, by means of hand grenades, in recovering some trenches but the mine crater remained in Bolivian hands.

Next day another attempt was made by the Bolivians, but without being able to make good their earlier gains. One tank broke down and the tank command refused to attack with a single machine in the face of the concentrated Paraguayan artillery fire.

In spite of their unquestionably gallant efforts the Bolivians had failed to take Nanawa. This was due to the efficacy and number of the Paraguayan machine guns; the Bolivian artillery, mortars and tanks proved quite inadequate to break the defense. In addition the Paraguayans were obviously in possession of large reserves which they appeared ready to expend without hesitation and utterly unsupported by heavier arms.

ALSO in the same Journal was published the following account of tanks in forest warfare by the commander of the Bolivian tanks: On August 24, 1933, the Bolivian troops, whilst advancing against Pirijayo, came upon a Paraguayan position sited in a clearing some 2 kilometers north of Pirijayo. The Bolivian infantry remained lying in the forest along the northern edge of the clearing, but pushed their way through the forest on either hand, one battalion (400 strong apiece) moved on either flank, one battalion remained in the center. The artillery halted 2,000 yards further behind, but did not fire at first. The infantry was dog tired and lacked water; many were six-month recruits.

At 12:45 P. M. the tanks (one section medium; one section light) were ordered up from their resting place ten miles northwest of Pirijayo. At 15.00 hours the two medium tanks came up; the light tanks remained behind. The crews were in good fettle and possessed war experience; but the temperature stood at 35° C., and all handles in the tanks were unpleasantly warm to the touch. (Note: The Editor of the *Gazette* states that "these two tanks were Vickers 7-ton machines; speed 15 m.p.h. on the road, 6 m.p.h on paths or level ground.") The section had also a reconnaissance patrol formed out of reserve crews, and a supply lorry.

At 14.45 hrs. the tanks arrived on the scene and a plan was adopted as follows: The tanks were to advance to the front and keep the southern edge of the forest under fire for 200 yards on each side of the path. The artillery was also to fire on the edge of the clearing so as not to endanger the tanks. The infantry was to work through the forest. At 16.00 hrs. the tank attack opened, but the machines after moving some 350 yards, halted in order to fire at the enemy. Nothing could be seen, but the impact of hostile bullets on the tank armor was continuous. The heat caused a chronic jamming of the machine guns; the 47-mm. gun had to cease firing after 40 rounds owing to the same cause. Tank '3' finally withdrew, unable to fire any further; the gunner had been badly wounded by a shot entering the aiming slit, while the commander was also slightly wounded. In tank 'Ina' the gunner had collapsed owing to the heat. The gun was still able to fire; the machine gun gave an occasional burst of fire until it failed completely.

Meanwhile the surprise attack of the tanks had caused the enemy to retreat in disorder to the east of the path, whereupon the Bolivian infantry followed them up. To the west of the path the Paraguayans were harder to dislodge, but as they kept on firing all their ammunition at the tanks, which offered admirable targets, the Bolivian infantry succeeded in ejecting them almost without loss. At 17 hrs. the edge of the clearing was in Bolivian hands and an hour later they were in Pirijayo. The tanks refueled and at nightfall took up their stand, one on each side of the path, to guard against counter-attack.

Adjusted Compensation Contract Boards

THE following Ordnance District boards have been appointed for the purpose of making a continuing study on the proposed wartime contract forms, especially the adjusted compensation contract:

Baltimore Ordnance District: Maj. William E. Grainger, Ord. Res., of the Bethlehem Steel Company; 2nd Lieut. Bernarde E. Anderson, Ord. Res., of the Krebs Pigment & Color Corporation; Maj. J. S. Hatcher, Ord. Dept., Recorder. *Boston Ordnance District:* Col. Charles H. Tenney, District Chief; Mr. H. C. Dodge, President, S. A. Woods Machine Co.; Mr. Alf Anderson, President, Albert & J. M. Anderson Co.; Mr. Alvan T. Simonds, President, Simonds Saw & Steel Co.; Lt. Col. Winthrop Sargent, Jr., Ord. Res.; Maj. George Paul Slade, Ord. Res., Attorney; Maj. Roger Taylor, Ord. Dept., Recorder. *Chicago Ordnance District:* Col. A. K. Hamilton, Ord. Res., President, M. H. Treadwell Co.; Lt. Col. F. A. Lorenz, Ord. Res., General Works Manager, American Steel Foundries; Lt. Col. Max Epstein, Ord. Res., Chairman, Board of Directors, General American Tank Car Corporation; Capt. Whitney B. Hobbs, Ord. Res., Superintendent, Western Electric Company; Capt. John Slezak, Ord. Res., Vice-President, Turner Brass Company; Maj. M. K. Barroll, Ord. Dept., Recorder. *Cincinnati Ordnance District:* Mr. Ludwig Kemper, President, Cincinnati Ball Crank Co.; Mr. George W. Haydock, Head of Haydock, Lamson & Co.; Col. Geo. G. King, President, King Powder & Peters Cartridge Co.; Mr. Vincent H. Beckman, Lawyer; Maj. A. C. Rasmussen, Ord. Res., Chief Engineer, Insley Manufacturing Co.; Mr. S. J. Hopper—general alternate. *Hartford Ordnance District:* Col. B. A. Franklin, Aux. Res., District Chief; Mr. John H. Goss, Scovill Manufacturing Co.; Mr. C. R. Burt, Pratt & Whitney Company; Maj. D. B. Wesson, Ord. Res.; Capt. J. A. Lavallee, Spec. Res.; Capt. R. D. Mallary, Spec. Res.; Capt. J. V. Montague, Ord. Res.; Maj. F. H. Miles, Jr., Ord. Dept., Recorder. *New York Ordnance District:* Col. Frank W. Roller, Ord. Res., President, Roller-Smith Co.; Lt. Col. C. O. Brown, Ord. Res., American Cyanamid Co.; Lt. Col. T. F. Brown, Ord. Res., Vice-President, National Distillers Products Co.; Lt. Col. C. E. MacQuigg, Ord. Res., Research Director, Union Carbide & Carbon Testing Laboratories; Lt. Col. Crosby Field, Ord. Res., President, Flakice Corp.; Maj. H. H. Hall, Ord. Res., Mechanical Engineer, Aluminum Company of America; Maj. R. L. Hall, Ord. Res., Technical Advisor, Kearny Plant of Western Electric Company; Lt. Col. H. K. Rutherford, Ord. Dept.; 1st Lieut. W. S. Broberg, Ord. Dept. *Rochester Ordnance District:* Mr. J. F. Cunningham and Mr. W. E. Hoffman, both of General Electric Co.; Mr. J. L. Crane, Attorney; Mr. James Gleason, President, Gleason Gear Works; Mr. Carl L. Bausch, Bausch & Lomb Optical Co. *San Francisco Ordnance District:* Mr. Roland Oliver, Pres., California Cap Co.; Mr. Milton S. Ray, President, Ray Burner Co.; Mr. E. H. Daniel, Treasurer, Columbia Steel Co.; Maj. K. B. Harmon, Ord. Dept., Recorder. *St. Louis Ordnance District:* Col. M. E. Singleton, District Chief; Col. Harry Scullin, Aux. Res., Pres., Scullin Steel Co.; Mr. F. W. Olin, President, Western Cartridge Co.; Mr. G. L. Evans, Vice-Pres., Wagner Electric Corp.; Maj. E. H. Sager, Ord. Res., Professor, Mechanical Engineering, Washington University; 1st Lt. G. C. Hetlage, Ord. Res., Hetlage & Company, Appraisal Engineers; Capt. L. J. Dillon, Ord. Dept., Recorder. *Philadelphia Ordnance District:* Lt. Col. Edward Wiener, Aux. Res., Lawyer; Maj. I. E. Lambert, Vice-Pres., RCA-Victor Company; Mr. Charles E. Acker, Treasurer, Baldwin Locomotive Works; Mr. E. Grant Tice, Special Representative, Bethlehem Steel Company; Mr. J. H. Hubbs, Purchasing Agent, United Gas Improvement Co.; Maj. W. L. Clark, Ord. Dept., Recorder.

Arms Fabricators

MEMBERS of the Army Ordnance Association will be interested in the projected work of the Arms Reference Club which is sponsoring the publication of a monumental work by Col. Robert E. Gardner on "Arms Fabricators, Ancient and Modern." The book will represent sixteen years of extensive research among thousands of documents in America and Europe and will contain a compilation of over 4,000 gunsmiths, their period and their specialties. Also will be listed the swordsmiths of America and Europe. The book will be published in deluxe style and size similar to Fuller's "The Breech Loader in the Service" which was sponsored by A. R. C. A. The prepublication price will be $6.50 per copy with lower rates for additional copies. Orders should be sent to F. Theodore Dexter, the very energetic and competent secretary of the Arms Reference Club and editor of the *A. R. C. A. Quarterly*, whose address is 910 Jefferson Street, Topeka, Kans.

Recent Patents

ORDNANCE patents recently issued include No. 1,949,423 to Harry A. Knox and Capt. Thomas H. Nixon for a track for track-laying vehicles which is constructed as a jointed link track but operates as a jointless band track. No. 1,949,418 to Forrest K. Howard for an improvement in the sear mechanisms of guns. No. 1,951,338 to Maj. G. M. Barnes, Ord. Dept., for a gun mount to be used for field and antiaircraft fire. No. 1,949,422 to James C. Karnes for a device to plot automatically the course of a target. No. 1,950,427 to Lieut. Arthur Willink, Ord. Dept., for a control system for the transmission of angular motion. Nos. 1,952,078 and 1,955,751 to Harry A. Knox, the former relating to a special track unit for track-laying vehicles, the latter to a form of shoe and bearings for such vehicles.

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Book Reviews

ROBERT E. LEE. A BIOGRAPHY. By Robert W. Winston. New York: William Morrow & Company. 1934. $4.00.

TWO well known writers have recently published their interpretations of Robert E. Lee. General Fuller's book which preceded Judge Winston's by a few months is concerned only with Lee's leadership in the Civil War. The strangely shrunken and curiously distorted figure of Lee that emerges from Fuller's pages will be acceptable to few military students, who will seek in vain for evidence supporting such views. This estimate of Lee is not based on hitherto unknown documents. Old and well known facts are given a new meaning by which Lee is improperly held responsible for national policies and failure of supplies. Has General Fuller forgotten the handicap of being a servant of a republic? In the nature of things, Lee could have been no despotic Alexander, even had he so desired. The time was therefore ripe for a study of Lee, not based on preconceived ideas, but offering an impartial and unprejudiced delineation of events and his influence on them. Judge Winston's biography accordingly makes its appearance at a peculiarly fitting moment. Without any thought of controversy while preparing it, unaware of General Fuller's thesis until his book was about to be published, Judge Winston has unconsciously provided a stirring and effective refutation of the British writer's principal criticisms of Lee. Judge Winston is not a professional student of strategy and tactics, and the military reader will detect a few minor errors of trifling importance. He has grasped the salient features of Lee's campaigns and in the nearly two hundred and fifty pages of his book devoted to the Civil War, he has competently reviewed Lee's stewardship of the Confederate forces.

This biography, however, is far more than a study of Lee in the Civil War. The heredity and environment that engendered him, the education that formed him, and the career in the Regular Army that prepared him for his future military greatness are adequately treated. It is evident that it did not take the Civil War to make a distinguished personality of Robert E. Lee. He was preëminent under all circumstances.

Nearly all earlier biographies of Lee have emphasized some particular phase of his career at the expense of the rest. What passed before and after the Civil War has been frequently regarded as insignificant. But Lee's extraordinary spiritual force and strength of character are possibly best revealed in studying his career prior and subsequent to the war. Judge Winston's book omits no period of Lee's life nor neglects any side of his character. It throws new light on such controversial subjects as Lee's attitude toward slavery, states' rights, and secession by publishing documents discovered by the author during his researches. Many anecdotes enliven the pages of this brilliant book which depicts a soldier, secure against iconoclastic disparagement, in whom all soldiers will recognize a paragon of their profession, in whom all Americans will rejoice as a luminous product of our civilization. D. A.

THE GHOST OF NAPOLEON. By Captain Liddell Hart. London: Faber and Faber Limited. 1934. 7s 6d.

IN this book Captain Hart renders a service of real value to every student of modern history by bringing out into the open and placing in their proper order works that have too long been hidden on the shelves of old libraries. Napoleon was such a student and it is ably shown in this treatise how he profited from his studies. It is the world's misfortune that succeeding genera-

tions had generals who, either through lack of industry or analytical ability, failed to understand the lessons of the past.

In his vivid style the author follows the trend of military thought from Maurice of Saxony to Marshal Foch, covering the development of two centuries. He dwells upon General Bonaparte's brilliant interpretation of Bourcet and Guibert, and upon the Emperor Napoleon's neglect of their teachings. But more important for us is the analysis of his interpreter, Karl von Clausewitz. This prophet's bloodstirring pronouncements obscure qualifying clauses that often contain truth; Napoleon I became the idol, not the skillful young general fresh from the school room; and military men of the twentieth century failed to read their texts carefully. Here is the tragedy; the men who were destined to lead the armies of Europe did not know their lessons. The result was disaster.

The last chapter is headed "Reflections," and forms a convenient synopsis of all that has been rushing through the reader's mind while his eyes traversed the preceding pages. For the book is provocative of much reflection. Evidently the author does not think it too much to ask of a nation's leaders, political as well as military, that they should be students of history in addition to being men of action. In the event that this ideal is impossible, he prefers men like Sherman who are able to rid themselves of doctrine and fall back upon common sense.

Captain Liddell Hart's books are always interesting and show the results of thoughtful study, but in recent works he has attained a literary style that enhances immensely the pleasure of reading him. It would be a great boon to any army if its general officers could be induced to read and appreciate his chapter on Clausewitz. A splendid bibliographical note is at the end. J.M.E.

BETWEEN TWO WORLDS. By Nicholas Murray Butler. New York: Charles Scribner's Sons. 1934. $3.00.

THIS series of addresses on government, politics and economics contains much sound thought, though nothing that will startle the informed reader. However, in this age of faltering democracy, it is refreshing to know that a man of Doctor Butler's prominence still has faith in the traditions and forms of representative government, and that the present economic tangle has not obscured his understanding of fundamental laws. Even in the realm of international relations, though the author's reputation as a pacifist might lead one to expect otherwise, it does not appear from an examination of this book that his emotion has greatly warped his good sense. Hardly more than a paragraph does he devote to the fashionable pastime of reviling those who would have their nation prepared to defend itself. Indeed there are many passages among his pages that show his recognition of the probability of the recurrence of war on a large scale. No thinking man can fail to sympathize with President Butler's aim in urging mankind to avoid the misery and waste of such conflict; he is calling upon us to mend our ways. In this connection a paragraph is worth quoting here:

"This economic war is being carried on with four weapons which are quite as destructive of peace and human happiness as are battleships and guns, airships and poison gas. These are high tariff walls, trade prohibitions and quotas, depreciated currencies, and disrupted international exchanges. These are the weapons which must now be renounced and displaced if this destructive and devastating war is to be brought to an end. There can be little use in renouncing war as an instrument of national policy if economic weapons be quickly substituted for those laid down by the military and naval forces of the nations." This interpretation of the economic scene is too often neglected.

The impression left by this book may not be what Dr. Butler intended, but it persists in spite of his idealism. It is, in brief, a warning to the effect that wasteful bureaucracies, bungling statesmanship, and commercial necessity are rapidly thrusting the world into disaster. To any one with an appreciation of human nature, that disaster can only result in war. J.M.E.

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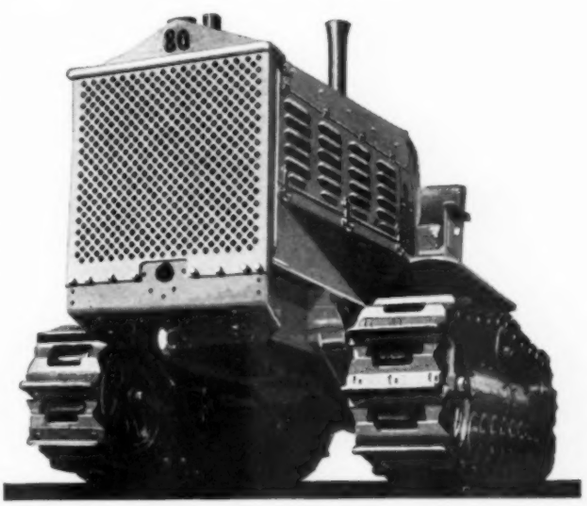

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—for Students of Military History;
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Kindly extend an invitation to membership to them.

.....
Member A. O. A.

THE LONG ROLL ON THE RHINE. By Col. E. Alexander Powell. New York: The Macmillan Co. 1934. $2.50.

AMIDST the great barrage of biased information flooding our journals and magazines regarding the political efforts of Germany to recover her national strength and prestige in the family of nations it is refreshing to read the book of Colonel Powell based upon his recent visits among the German leaders and their followers. In the first place, Powell can write clearly and entertainingly. He can present a clear and convincing word picture of what he has observed. And on the other hand, he knows Germany and her neighbors quite as intimately as any of our American writers. The years he has spent around Europe have been hectic years of intrigue and counterplot, and he has had his ears and eyes listening and watching every moment. What he has seen recently is evaluated in the light of all the recent diplomatic and domestic maneuvers with which he is thoroughly familiar. Consequently, his book is accurate in so far as an observer can be accurate. His expectations, expressed rather freely, are clearly within the probabilities, yet startling to those whose pacific trends of thought lead them to hope for judicial rather than military solutions of Europe's difficulties.

Powell's arguments and reports favor Hitler. He cannot restrain his admiration of the man. And so do all those who have faced those clear penetrating eyes of the new chancellor. But Powell singles out the Hitler mistakes, typical German errors in psychology, such as those which lost the World War and have appeared so clearly to the rest of us after the errors were made.

Powell is not afraid to argue the questions of the Polish corridor, of the mine fields of Silesia; of the troubles of the Saar; of the heavy tramping of the little Chancellor of Austria; of the plight of the Germans in Czechoslovakia, Poland, Italy and elsewhere without the boundaries of the Reich; of the Anschluss; of the absence of contact with the high seas of Austria and Hungary and Bulgaria and of the discontent of so many peoples of every nationality over the arbitrary boundaries established by the post-war treaties. And also Powell is not timid about pointing to the most probable future attempts of the interested and unsatisfied groups of Europe in seeking a way out of their present distress. No one can go very far in prophesy about such things, for there are too many issues. The solution of any of them in a particular way will change the possible solutions of the others. He has covered a wide range of these possible happenings and actions, all of which affect the peace of the world and its spiritual and economic contentment.

Our own national economic and political life will be profoundly affected by whatever changes the European nations accomplish in their efforts to readjust the failures of Versailles. For after all we are bound by trade, by inheritance, by religion, by custom and by constant contact with every race on the continent and its isles. Our own people live and trade there in thousands, our products are sold there to the value of many millions of dollars. The credit which we have given across the Atlantic during and since the war and which in a lesser measure, we are still giving, is indeed far beyond the capacity of any of our exhausted debtors to meet at any date of settlement. Yet we cannot withdraw nor foreclose. The interrelated investments of our people and of the European peoples in communication, transportation, manufacture and monumental structures all over the world require that we continue to work together to feed and to clothe and to comfort all these peoples as a world group, and to take a keen and ever increasing interest in the progress of each of them. Powell does not let these interests lie unnoticed but entwines them in his discussions.

It becomes increasingly apparent from his notes and arguments that the policies of the pan-German movement of which Hitler is the recognized leader, must be directed in every diplomatic contest in one general direction. In the long run, when military strength has been added to the industrial prowess of these fecund

and aggressive people, those things which are essential to their advancement and happiness will come to them by one means or another, in spite of all the fortifications and armies and diplomatic hindrances of their opponents. The effort toward the east has not been abandoned. The ports of the world will see more and more German flags on the mastheads of fine ships, and German products are destined to become even more familiar than they were before the defeat of the German armies.

If their new progress does not again turn their heads to an arrogant challenge of a jealous world, surely all the east soon will be their debtors and the rest of the world ought to be a happier and busier place to live in.

Powell is entertaining and convincing. His book is up-to-date and full of predictions. When it has been read through, turn back and reread the title. You will wonder when the drummer of Ehrenbreitstein will sound that long roll that begins another movement of millions out of the East towards the plains of France. C. G. M.

NAPOLEON AND HIS MARSHALS. By A. G. Macdonnell. New York: The Macmillan Company. 1934. $2.50.

THIS book is recommended to any one who wants a few hours' entertainment. It is interesting and amusing and, though obviously written for popular consumption, it presents a picture of human relations in the Napoleonic armies that the student of military history should not fail to bear in mind. Volumes of more imposing aspect contain better accounts of the triumphs and failures of the Republican and of the Imperial commanders, discuss the technical features of their campaigns in more detail, or dwell at greater length upon the consequences of their omissions and neglects. But few books as readable as this one expose the little vanities and vices, the petty squabbles, which in the end had such tremendous influence upon events. The personal weaknesses of individual corps commanders have an important bearing upon the effectiveness of an army, and Napoleon's difficulties were not all matters of high politics and grand strategy. Indeed it appears that he could have saved himself much trouble if he had directed a greater part of his genius toward keeping order among his subordinates. With all their faults, however, Napoleon's marshals were fighting generals; in his brief account of their early lives, Mr. Macdonnell leaves no doubt of that fact. Marmont bringing up his four guns at Marengo; red headed Ney, musket in hand, fighting off Russians at the Beresina; Murat dressed in all his splendour leading a cavalry charge at Borodino, these familiar scenes are sketched in with a nice regard for their romantic quality.

But we are also told what the marshals were before they became such grand figures, and what they did afterwards. There is another small matter which the author brings to our attention, a point the significance of which seems to have been entirely lost in the obscurities of history: "At the battle of Austerlitz Napoleon was thirty-six, Berthier fifty-two, Bernadotte forty-two, Davout thirty-five, Soult thirty-six, Lannes thirty-six, Bessiéres thirty-seven, Murat thirty-eight, Mortier thirty-seven, the average age being thirty-nine. Kutusov was sixty." J. M. E.

A YEAR'S EMBASSY TO MUSTAFA KEMAL. By Charles H. Sherrill. New York: Charles Scribner's Sons. 1934. $3.00.

THIS book has very little to say of the author's embassy to the President of the Turkish Republic and therein it does not fulfill the promise of its title, which is a small matter. On the other hand, one receives the impression that General Sherrill's personal and official relations with Mustafa Kemal have effectually blocked adequate biographical treatment of the great Turk. If this is true it is unfortunate because he deserves more than mere laudatory essays from his contemporaries. A ruler who can, as the Gazi has done, cut his country's losses and consolidate its military and political assets into a compact, homogeneous

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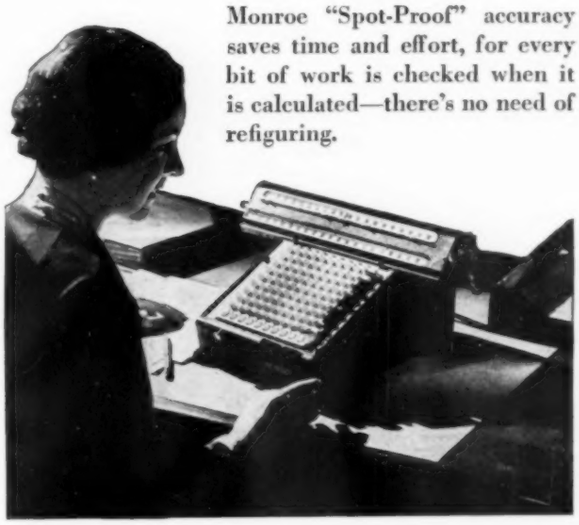

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The editorial appearing on pages 41-44 of this issue of ARMY ORDNANCE is being reprinted in pamphlet form. Copies of it, as well as copies of the first of this series of editorials under the same title which was published in the May-June issue, will be furnished without cost.

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nation, and still ride the crest of the wave; that man can stand a deal of critical investigation, especially from foreigners.

General Sherrill's book will stimulate the military man to look further into the campaigns of Mustafa Kemal, for there is little doubt that he displayed talent of a high order, both in organization and in the field of grand tactics. He appears to be the true intellectual commander who can appraise the qualities of his race and use them with a skill comparable with the greatest of his predecessors. The Gazi's accomplishments in the political field are related categorically; the nature of the material he had to work with, the difficulties he overcame, and the manner in which he forced a republic down the throats of a Mohammedan people are not disclosed. Perhaps it is the indication of a good book that we should want more.

The Gazi is evidently one of those who talk with a pencil in hand. Five of his rough sketches are reproduced and they are excellent. General Sherrill is at his best when he takes up the subject close to his heart; a delightful description of Stamboul's palaces and mosques appears in the appendix. A map of Turkey in the back of the book would have been convenient for the Occidental reader. J. M. E.

Italy's Part in Winning the World War. By Griard Lindsley McEntee. Princeton: Princeton University Press. 1934. $2.00.

THIS is a clear, brief account of the major facts, military and naval, connected with Italy's effort in the World War. The author has stated in the preface that the work has grown out of his lectures on this subject. As a result, his book contains the virtues and many of the faults that are common to that form of presentation. Among the former may be listed conciseness and simplicity, which outstanding qualities should enhance its popularity with those whose time is limited. Also Colonel McEntee should be complimented upon the many excellent maps and charts which make this small volume a very welcome addition to any military library. Moreover he has been liberal with photographs of Alpine positions that serve in an effective manner to emphasize the point that Italy had an extremely difficult problem. Indeed her expectation of conducting a successful offensive, one that should result in a decision of importance, seemed doomed to failure by the extraordinary nature of the terrain alone. And yet, there were twelve major efforts on the Isonzo! This was the way in which our commanders "place the enemy on the horns of a dilema." But they were conducting a war of attrition, which is a queer kind of war, especially with gentlemen whose mathematics have become a little rusty. Colonel McEntee's chart of casualties is interesting in this connection: The British Empire, France, Italy, and Russia suffered 13,000,000 casualties against 7,800,000 for Germany and Austria-Hungary. Another item of interest which is clearly illustrated in this work by hard, black lines and brutal, tell-tale arrow-heads is that Mr. Lloyd George and other advocates of war in the East were not far wrong; it was Bulgaria that crumpled on September 30, 1918.

There is nothing new brought out in this book, no military criticism or opinion expressed, and much that is pertinent to the subject is left out, but one cannot overlook the value of plain black and white diagrams. A bibliography in the back of the book will suggest material for further investigations. J. M. E.

Infantry in Battle. Washington, D. C.: The Infantry Journal, Inc. 1934.

THIS text on a section of the basic principles of warfare was prepared at the Infantry School by a group of officers mentioned in the preface. The School and these gentlemen are to be congratulated, for they have given us something distinctly out of the ordinary. There are twenty-seven subjects taken up and illustrated ingeniously by actual situations which confronted subordinate commanders in the World War. In this respect the work is particularly valuable, since few books on the conduct of war

deal with such small fry as battalions and regiments. Ordinarily the diligent student reaches a state in which he is fairly sure of himself should he be called upon suddenly to command a corps or an army group, but secretly he is quite stumped by the practical and much more probable assignment to lead a platoon. These statements of how fighting officers solved their problems in the last war, and the analyses of the problems with short comments to connect them with time-worn maxims that are so easily forgotten, are quite in the modern spirit of scientific approach and do not violate their own precepts of simplicity and clarity. Excellent sketches are provided liberally.

However, several points invite criticism: There is an important chapter on the "Infantry-Artillery Team" but, for some reason, there is nothing on infantry support of cavalry. It would seem that something of value might have been gleaned from the experiences of units of the British Nineteenth Brigade in August, 1914, or from reports of several of the lower subdivisions of General Allenby's command in Palestine. Another item of neglect is the presentation of a few of the special problems that enter into mountain warfare. Most glaring of all is the failure to provide at least a few instances of infantry-tank coöperation. Student officers should not be allowed to forget that they will have tanks either in support or in opposition. But in spite of such omissions, officers of all arms will profit by study of this book, the basis of which is twenty centuries of warfare. J. M. E.

FUNDAMENTALS OF INSTRUMENTATION. By M. F. Behar. Pittsburgh: Instruments Publishing Company.

THIS volume is part one of "The Manual of Instrumentation" by Maj. M. F. Behar, Ord. Res., editor of *Instruments*. Other volumes comprising the entire manual include tests on the measurement and control of temperature, humidity, pressure, time and speed, flow, electricity and other subjects, eight parts in all.

The book begins with a specially clear and comprehensive description of the general field of instrumentation which has been called "the sixth sense of industry." One might almost say that the analysis here presented is a scientific version of what older heads knew as natural philosophy. Indeed there is a philosophic background to the entire approach because industrial instruments today, classified according to the objects of measurement as given in Major Behar's chart, strive to determine the qualities and characteristics of materials for which philosophers delved for centuries. However, the purpose here is far more practical than any amount of theory and the general principles underlying the analysis and control of modern instrumentation are put down as a guide for investigators and producers.

There are two portions of the book which should not be overlooked. These are Chapter 4, "The Plant Instrument Department," wherein practical contributions are made by officials of seven of the country's largest instrument users and makers, and a bibliography which should be indispensible to those who are in any way concerned with instrumentation. C. A. J.

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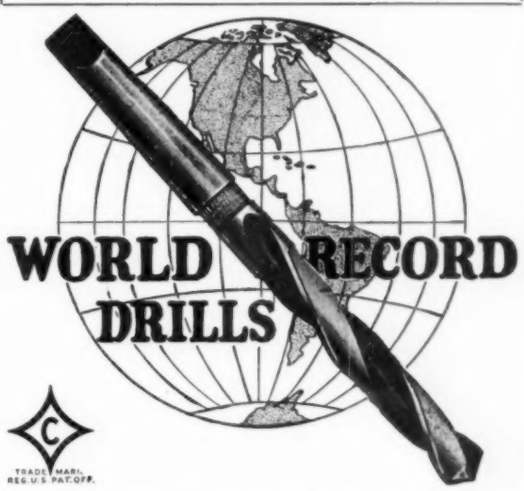

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